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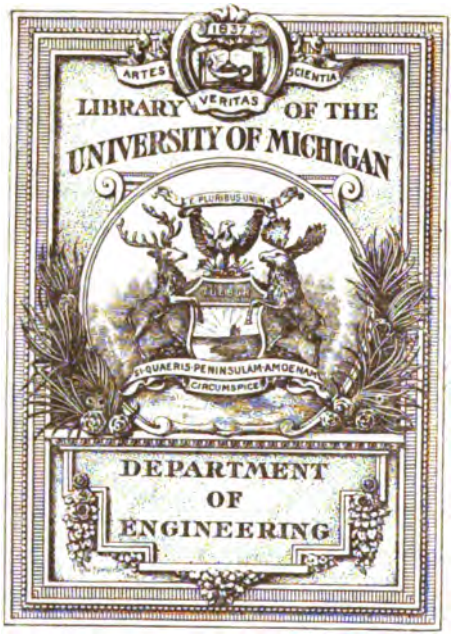

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TACTICS AND TECHNIQUE

OF

RIVER CROSSINGS

BY

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105 ILLUSTRATIONS AND FOUR MAPS

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PREFACE.

A portion of the following pages appeared in the "Professional Memoirs of the Pioneer Corps," published by the Fourth Section of the Engineer Committee. The favorable reception accorded these essays by officers of the corps has prompted me to make them available to a wider circle of officers. In taking this step, I feel that I shall do my share in raising the appreciation in our army of the importance of coöperation between the pioneers and the other arms, to the end that the technical duties of my corps and its special training in combats for the possession of river crossings may be fully utilized in obtaining tactical success. It is not sufficient for leaders and troops to know the principles that govern such combats, as laid down in paragraphs 62–97, Pioneer Field Manual; they must also be familiar to a certain extent with the technical side of pioneer work in order to appreciate what the pioneers want to do and can do and to understand how important it is that they be supported if full advantage is to be derived from their work. Sympathetic study of their technical work and the acquisition of a knowledge of their powers and limitations are especially welcomed by pioneers, for their difficult and grateful task of breaking and smoothing the way for the army will be facilitated thereby.

MERTENS.

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TRANSLATOR'S PREFACE.

The translator had hoped to retire from the field after completing Volumes I and II of Balck's Tactics, but a request made to him to give another tactical work to our army, coupled with the worth of the subject matter and its great importance in the present world war, prompted him to reconsider his decision. If his present effort proves of benefit to brother officers of all arms, he will feel amply repaid for his labors.

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RIVER CROSSINGS.

GENERAL.

Large numbers of bridges will have to be constructed by the pioneers in campaign. A considerable part of their peace training is, therefore, very properly devoted to constructing bridges with service and improvised matériel. Purely technical skill alone does not suffice, however. The really difficult part of bridge construction, that of harmonizing the technical requirements with the tactical situation, of executing the work in co-operation with the fighting arms, mayhap in face of hostile opposition with its attendant influence on reconnaissance, preparation and execution, is either wholly or at least partially absent on the training ground. Nothing but practical exercises on the terrain, experience at maneuvers, tactical rides, a study of military history, etc., can give all arms an idea of the difficulties of the undertaking whose technical result is the construction of a bridge across a water-course. They will demonstrate that bridge construction within striking distance of the enemy, is not primarily a technical task for pioneers, but that all arms must coöperate; that it does not suffice for the pioneers to be equal to their task and to devote their whole energy to its execution, but that all leaders must understand how to issue appropriate orders in the premises, and that all troops must exert their whole energy and, if necessary, their whole fighting power, in order to make the operation successful. Lessons learned from peace exercises and from military history will prevent overestimation as well as underestimation of the magnitude of the technical task involved; they will demonstrate that there is no hard and fast method of crossing a stream, and that tactics and technique must work hand in hand to secure results.

Technical considerations are but too apt to predominate in bridge work executed in the immediate presence of the enemy. To be sure, even in this case, technical requirements are im-

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portant and, in many cases, may even govern, but they should not dominate the situation. Technical work can render its most valuable service only if it is done with a view to forestall the enemy or to deprive him of initiative, if it is animated by vigor and energy, if full confidence is placed in force, which is its hand-maiden, and if the superiority of our own morale and the element of luck, which is ever on the side of the offensive, of the efficient, of the bold, are properly appreciated.

Moral factors and chance play as great a part in river crossings as in other operations of war. It would be wrong to take the bull by the horns on principle. To hide one's intentions and to launch the bulk of one's force at a point where the enemy does not expect it to be launched, are just as important in river crossings as in a pitched battle. It would be equally wrong to suppose that a river crossing can be properly initiated by stealth and by cunning alone. Likewise, the crossing as usually practiced during our annual pioneer exercises, the frontal night attack on the hostile position, special attention being paid to deceiving and misleading the enemy, should not serve as a model to be followed in all cases. This most difficult form of all river crossings should be frequently practiced. But it does not follow that this method, which leaves so much to chance and stakes so much upon a single card, is, as a rule, employed in face of an enemy who occupies the opposite bank. This idea is nowhere laid down in our regulations. Our ponton regulations refer to the importance of promptness and force in river crossings and our new Pioneer Field Manual states:

"67. If there is a chance of gaining the opposite bank ahead of the enemy and of making a lodgment there, full advantage should be taken, above all else, of the start gained over the enemy, by promptly throwing some troops across."

"68. A crossing may be forced if fire superiority has been gained and can be maintained so effectively that the enemy can not bring effective fire to bear on the points of crossing. The chances of success of such forced proceeding are especially good if the opponent has been shaken by previous fighting."

These methods of crossing a river take no account of tedious preparatory work, of darkness and the uncertainty of night, but depend upon prompt and energetic action and upon the ruthless use of force.

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The thing that the commander will demand in almost every case is that the water-course that obstructs the progress of the operations be quickly surmounted. This task will be almost exclusively technical only in case the enemy is at a distance. But when strong hostile opposition may be expected, tactical and technical work must go hand in hand in order that the probably very difficult task may be executed with certainty and despatch. The commander of the troops is responsible for the crossing and takes the necessary tactical measures, and the senior pioneer officer directs the technical work in accordance with the wishes of the commander of the troops. But tactical measures that are not consonant with technical requirements and possibilities may be just as disastrous as technical plans that do not meet tactical demands. Technical difficulties can not be surmounted by "order"[1] and minor technical objections may, if they have any determining influence, knock even the best plan of operations into a cocked hat.

Another thing should be pointed out. The technical work required in crossings is almost exclusively a task for pioneers. While they will do all that is required of them in this connection, their capacity is not unlimited. Though they have at present excellent bridge equipage at their disposal, they may easily fail because of the multitudinous tasks imposed upon them. Not only the enlisted personnel, but commanders of pioneers as well, may be literally swamped by the mass of duties devolving upon them. It would be a grievous blunder for the higher commander not to provide the necessary pioneer troops where they are needed, in other words, in extremely critical situations in which everything depends upon certainty and despatch. The higher pioneer officers should make timely and forceful representations as to any shortage of technical troops and recommend that pioneer troops be drawn from other units when those attached do not suffice.

When a division has to effect a difficult crossing, instead of leaving both the technical direction and execution in the hands of the senior pioneer officer of the division, who should, very properly, be allowed full latitude within his sphere, it will frequently be a good plan temporarily to attach to the division staff the commander of the pioneer battalion of the corps. It

[1] See Balck, "Taktik," VI, p. 192.

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would, of course, be preferable if our organization provided for the permanent assignment of a higher pioneer officer to a division, who would command all the pioneer companies of the division and would decide all technical pioneer questions and be charged with the direction of all difficult technical work. If this were done, the commander of a pioneer company would be relieved of a part of his present responsibilities and would not be burdened with a dual duty, that imposed by his company work and that imposed by his divisional work, upon the proper execution of which the success of many very important operations frequently depends. Likewise, when an army intends to cross a wide stream, it might be a good plan to attach the general of pioneers at army headquarters to the army corps charged with effecting the crossing, and to let that officer take charge of the entire technical direction of the operation.

"The preparation for and execution of pioneer work require time. It is therefore important for the commander to know in plenty of time what will be needed." (Par. 4, Pioneer Field Manual.)

It may be safely assumed that our army is conversant with this fact and requirement. Nevertheless, it will take not only foresight and energy, but a good deal of tact on the part of commanders of pioneer troops to suggest to higher troop commanders the necessity of timely issue of orders covering the preparation of crossings.

In speaking of the use of pioneers during the battle of Wörth, especially in discussing the tardy action of the pioneers in bridging the Sauer, Major Kunz states:[1]

"It is particularly important that the commander of the pioneers of an army corps be selected with great care. This officer should be so forceful that, even during the critical moments of a battle he will not shrink from reminding his superiors of the fact that if a bridge is to be of any use to the fighting arms, *it must be built in time* and that even the most capable and best pioneer officer can not build a good bridge unless he has adequate material and sufficient tools. But it does not suffice for him to point out these things only; he should, moreover, see to it that the ponton train is brought up in time. This requires

[1] "Kriegsgeschichtliche Beispiele aus dem Deutsch-Französischen Kriege," 18, p. 85.

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that roads on which the heavy vehicles of this train can be brought up without blocking the routes of approach of the fighting troops, should be reconnoitered in advance. It requires, further, that, when necessary, the pioneer commander in question, swallow without a murmur any ungracious remarks of his commander that his activity brings down upon his head, for there is not likely to be any dearth of such remarks during the stress of a great battle.

"Everything must be subordinated to the welfare of the state. If the commander of the pioneers of an army contributes materially by his energetic and capable measures to victory, he may rest assured that the 'ungracious remarks' will be converted into a decoration, aside from the fact that he will have the proud consciousness of having done his whole duty well."

It will be easier for the pioneer commander to get his commander's attention if, of his own accord, but within the bounds of proper subordination, he prepares for executing future orders by making timely reconnaissances, by holding his force and ponton trains in readiness for a prompt advance, by securing improvised material, etc. If the situation is critical, if the state of the weather (rainstorms, etc.) requires the presence and action of pioneers (Sauer, Katzbach), pioneer commanders should be particularly energetic and should anticipate where the leader will need their advice and the assistance of their units. Such foresight will be the best method of gaining and keeping the confidence of the commander and of the troops, which, once lost during critical days, especially at the outset of a campaign, is very difficult to regain.[1]

A plentiful supply of service bridge equipment must be placed in readiness. It is with such equipment only that bridges that meet all demands of service can be quickly built without special preparation. Therefore, if the operations are to proceed rapidly, abundant service bridge equipage should be provided. Even short improvised bridges require a good deal of time to construct if difficulties are encountered in transporting material.[2] In this,

[1] See also the excellent discussion contained in the essay "Der Übergang über die Schlei," which appeared in "Kriegstechnische Zeitschrift" of 1901, p. 234 et seq.

[2] The extensive use made of improvised material by the Japanese in throwing bridges over the Yalu in 1904, is explainable only by the totally inadequate supply of service bridge equipment provided by the Japanese

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likewise, the large annual pioneer exercises should not lead to misconceptions. During these exercises, the construction of large and important bridges with improvised material is often demanded, and with justice, for it is not only excellent practice for the captain of pioneers, but for his company as well, to employ improvised material under difficult conditions, since, in actual service, one will often enough be forced to use it. But it is not desirable to utilize improvised material under the conditions in question. We should make bridge work in war, so far as rapidity of construction is concerned, as easy as possible, and that requires, above all else, an abundant supply of service bridge matériel. In this connection, a heavy responsibility, requiring care and foresight, rests upon higher pioneer officers. This applies particularly to timely bringing up of the ponton train.[1]

The trains should not be required to make a long march to reach the crossing point on the day on which a bridge is to be constructed, especially if the roads are soft or rough, as they are

staff. The consequent slowness of the crossing should have given the Russians plenty of opportunities to ascertain the crossing points at an early moment and to throw themselves with vigor upon the troops that crossed.

In the past, the procurement of improvised material, especially the gathering of boats, rafts, etc., consumed so much time that crossings were frequently protracted to weeks and months.

[1] When it became necessary, during August, 1870, quickly to bridge the Moselle, the bridge equipage of the pioneers was frequently not where it was needed. Frobenius states in this connection, in "Geschichte des Ingenieur und Pionierkorps," II, p. 17: "The following shows what reliance could be placed upon the bridge train. On the evening of August 14th, Moltke directed that, as 'it is imperatively necessary to advance in force on the left bank of the Moselle against the enemy's lines of communication, Metz–Verdun, the IIId Army Corps will prepare a crossing below Pont à Mousson on the 15th.' When this order reached the headquarters of the IIId Corps, the staff appears to have bethought itself for the first time of the ponton train, for Lieutenant Pfeffer was hurriedly despatched on the 15th to hunt for this train, whose whereabouts no one knew. Where was the ponton train? Arrived by rail on the 7th at Mosbach, where it detrained, it reached Neuenkirchen on the 12th, and Saarbrücken on the 13th, where it awaited orders. When none came, it continued its march on the 15th and had reached St. Avold (52 km. from the Moselle), where it no doubt expected to remain, as the men were engaged in feeding and watering, when an order (the diary does not state by whom issued nor by what route despatched) arrived directing it to advance rapidly and to throw a bridge across the Moselle at Arry. At 6 P.M., accordingly, the train resumed its march, reaching Herny, where it was met by Pfeffer, late that night. It still had some 30 km. to go to reach the Moselle and covered this distance between 5 A.M., and 12:45 P.M., on the 16th."

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very apt to arrive hours too late, thereby jeopardizing the success of the whole undertaking.

It is not the purpose of the following pages to go into questions of strategy nor into the part played by river crossings in the operations of large armies.[1] On the contrary, it is to be taken for granted that a river is to be crossed at some suitable point or points. Within these limits, it is proposed to investigate the relation between tactics and technique in offensive operations in which it becomes necessary to cross a water-course over which there is no bridge available on the line of operations. To be sure, the result will, in most cases, be a crossing by means of a bridge, and how the construction of this bridge may be made tactically and technically possible, frequently in the face of hostile opposition, that is the element in the ever changing situation that is here to be investigated.

A strict division and classification of the various cases that may arise is, indeed, not always possible as the methods to be employed overlap. Often, in order to succeed, promptness must be coupled with force, or surprise with force, and frequently surprise with special expedition. Neither is such classification always of practical value. Though it may perhaps be possible to ascertain the characteristics of each river crossing —after the event, in order that it may be assigned to a definite class or group, in reality the situation confronting a leader is rarely so clear that he could know to what particular class or group it belongs.

Nevertheless, an attempt will be made to classify the various kinds of river crossings in accordance with the Pioneer Field Manual, for only by doing this can the points that deserve attention be logically developed. But it is by no means desired to formulate a scheme of hard and fast rules that, without regard

[1] The part played by river crossings in the larger operations and the incidental tactical and technical measures are treated in some excellent essays by Fieldmarshal-Lieutenant A. Hausenblas and Major J. Turba, both of the Austro-Hungarian Army, in "Mitteilungen über Gegenstände des Artillerie und Geniewesens," Nos. 9–12 of 1912, and Nos. 1–2 of 1913.

Colonel Balck has similarly treated the relation existing between large operations and the crossing and defense of river lines, in "Taktik," VI, "Kampf um Flusslinien." He is perhaps the first of our modern military authors who, in the light of numerous examples from military history, discusses the most important requirements and attainments of pioneer technique that played a part in the various situations cited.

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to the peculiarity of each and every individual situation, aims to find among events of the past a model acclaimed as a panacea.

The Manual mentioned differentiates between the following classes, viz.,

I. (Par. 66.) When the bridge is constructed at a distance from strong hostile forces. In this case, perhaps nothing but an interference on the part of hostile patrols and of weak detachments may be anticipated.

II. (Par. 67.) When the enemy, due to the rapid progress of the operations, either has not as yet been able to provide for securing and guarding a stretch of river, or has not as yet reached the river at all. In this case, advantage is taken of the start gained by prompt occupation of the opposite bank.

III. (Par. 68.) When the enemy intends only to delay the attacker on the river line, either with a weak force or by fire delivered from a position farther in rear. In this case, a crossing is forced.

IV. (Par. 69.) When the enemy has provided a more or less extensive covering force on a broad water-course, with the intention of opposing the assailant with a strong force either while he is in the act of crossing or soon thereafter. In this case, the attacker, after careful preparation, gains possession of the opposite bank by surprise, either by evading the hostile forces altogether, or, when necessary, by striking directly at the hostile front with all the force at his disposal.

These studies are prefaced by examples of concrete cases, even those of peace time being included. From a technical point of view, the latter may illustrate conditions that closely approximate those of war. Moreover, they are frequently well adapted for clearly bringing out the motive animating the opposing leaders and for furnishing a proper standard of the value of details, although the factor of actual hostile influence is entirely lacking.

I. BRIDGE CONSTRUCTION OUTSIDE THE EFFECTIVE ZONE OF STRONG HOSTILE FORCES.

EXAMPLE.

On August 15, 1870, the 22d Infantry Division, advancing from Lunéville on Bayon, received a message from its advance

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cavalry to the effect that the bridge over the Moselle at Bayon —on the line of advance of the division, was destroyed, but that there was no enemy in the vicinity.

The 1st Company, 11th Pioneer Battalion, charged with reconstructing the bridge, after gathering some improvised material in Xérmaménil, advanced ahead of the division toward the Moselle. Fifty pioneers were mounted upon the light bridge train, some more followed on requisitioned farm wagons, and the remainder marched, their packs being carried on wagons. This enabled the march to be accelerated—the wagons

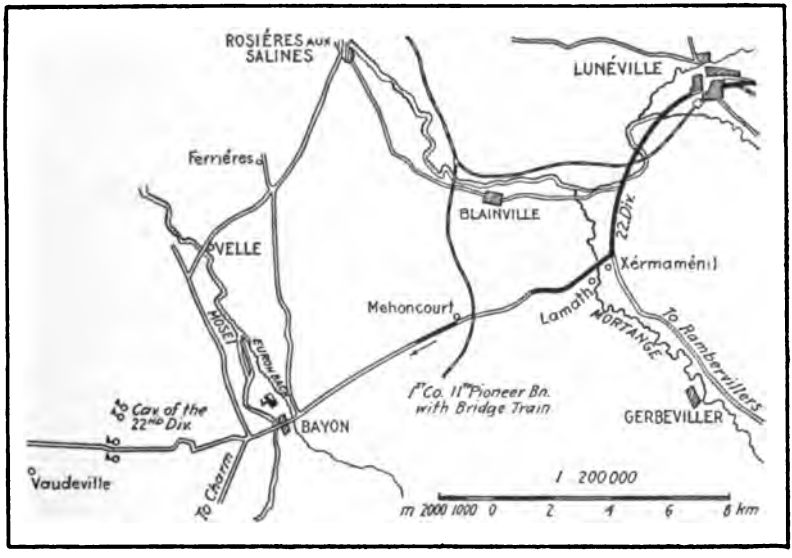

Fig. 1.
Bridge Construction at Bayon, Aug. 15, 1870.

often moving at a trot, and the construction of the bridge over the Moselle begun with fresh troops. A few patrols on the left bank of the river sufficed for local protection. The bridges over the branches of the Moselle at Bayon were completed so quickly that the outposts of the division could be posted on the opposite bank without a single minute's delay.

GENERAL.

At least ninety percent of all bridging operations in the field are similar to the one at Bayon. They usually involve the con-

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struction of bridges in localities where strong hostile forces need not be anticipated, but where at most only small hostile forces or patrols may be encountered or may be able to operate. Such bridging operations have also frequently been executed in the immediate presence of the enemy in cases where the latter either refrained from interfering with the crossing[1] or did not perceive at all that a bridge was being constructed in his vicinity. In this category may be included the majority of river crossings that are necessary during the pursuit of an enemy whose rear guard is weak.

Although the reconnaissance of a river course as to the practicability of crossing it, should be made by pioneer officers as far ahead as possible of the leading elements of the marching troops, at any rate before the troops arrive at the river bank, the actual construction of the bridge will usually not be undertaken until the troops have reached the obstacle. It is then a very simple matter quickly to make the necessary tactical dispositions to cover the bridging operation. This is especially true when a water-course stops a pursuit, the troops naturally closing up and covering troops being promptly detailed to push across in some way or other and to drive off and to keep at a distance any disturbing hostile detachments.

If, like at Bayon, bridges must be constructed ahead of the leading elements of route columns, or if pioneer organizations are despatched to a flank or to the rear for such a purpose, some infantry or cavalry should be sent along for their protection if encounters with weak hostile detachments are to be feared. In many instances pioneers may even have to furnish their own protection.

In discussing bridge construction at a distance from strong hostile forces, the conduct of covering troops will for the present be omitted, to be taken up later. The technical side of such work, in so far as it is of general interest, is first to be examined. But it is just as well to point out that, aside from the covering

[1] On August 31, 1870, the 1st Field Pioneer Company of the XIth Army Corps threw a bridge over the Meuse at Donchery, within 2 km. of the fortress of Sedan. As there was no infantry on the spot, the company itself provided for the security of the work. Later on a company of infantry that had been detailed to cover the bridge work, cleared the nearby villages of French stragglers, who had, however, not thought of interfering with the construction of the bridge.

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troops posted at some distance from the crossing, a small covering group should be posted in the immediate vicinity of the farther end of the bridge as local protection. It is desirable to connect the advanced covering troops with the bridge site by means of flag or telephone. The troops constructing the bridge must be in instant readiness for action in case any interruption of the work, even if only by patrols, is to be feared.

The pioneer commander must give his whole attention to the problem of constructing a serviceable and reliable bridge in all circumstances. In many cases, it may be desirable to hasten the work of construction. When this is the case, it must not be done at the expense of reliability of construction, but through timely preparation, foresight, and careful division of labor.

Extraordinary demands are often made on the reliability of construction, and this is not always sufficiently realized in peace time exercises. On September 1st, 1870, the Bavarian Ist and IId Corps, as well as parts of the Prussian IVth Corps, crossed over the two bridges hurriedly thrown across at Remilly by the Bavarians. In addition, these two bridges were during the entire day covered by ammunition columns, sanitary columns, and convoys of wounded. If one remembers what a great load is nowadays thrown upon a military bridge by the heavy artillery attached to a corps and by army transport columns (with an axle load up to 140 cwt.), one will be impressed with the absolute necessity of reliable construction. An interruption of a crossing might have incalculable consequences.

Of quite as much importance as the reliability of the bridge itself, are the roads leading to and away from the bridge. Even the best bridge will be useless for heavy traffic if the roads leading to it are not adequate. Cultivated ground and meadows, unless conditions are very favorable, for example in case of drought or frost, make the most unsuitable approaches to bridges. After brief usage, deep ruts will form in them, necessitating permanent improvement; rain will convert them into mud holes, and their usefulness can be restored only by connecting the nearest firm road with the completed bridge by corduroying: at best an extensive task requiring much material.[1]

[1] During the middle of December, 1870, the 1st Pioneer Company of the Guards threw a bridge over the Marne at Vaires. On the one bank the approach led over about 240 m. and on the other over about 650 m. of cultivated

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Therefore, whenever possible, permanent roads should be selected as approaches, and even rather expensive work entailed in reconstructing destroyed bridges should not be avoided, so long as the firm and comfortable roads leading to the destroyed bridge may be utilized. Frequently, one will be content with quickly constructing a bridge with service equipage alongside the destroyed bridge and will have to put up with worse bottom, steeper approaches, and more pronounced bends. But if the situation requires that a permanent crossing be maintained at that particular point, the old bridge should be reconstructed—usually with improvised material, simultaneously, if practicable, with the new bridge.

Sometimes the desire quickly to cross narrow streams or gaps in partially destroyed bridges, leads to the construction of foot bridges[1] or light bridges.[2] The French have constructed and tested such bridges, which they transport on wagons and can throw across a gap in a very short time (see Appendix I), for example, to prevent the advance of their infantry from being impeded by destroyed bridges of medium span. But it should be remembered that the construction of such bridges without preparation usually takes a good deal of time and that, in the end, the bridge can not be used by horses and vehicles at all or at least only with great caution. It would be much better to utilize the division bridge train to throw a light bridge across a stream if the farther bank can not be reached in any other way with the available material. To convert a bridge of this character into a real bridge would not encounter insuperable difficulties. To be sure, the lack of service and improvised material has often compelled troops in campaign to be satisfied with light bridges of the most precarious description.

The prompt construction of a bridge under the conditions mentioned may be best facilitated and prepared by—

1. Timely and appropriate reconnaissances and preparations;
2. Husbanding the strength of the pioneers as much as

ground. When a thaw set in these approaches became quagmires, and as it was impracticable to transfer the bridge to another locality, the company began to corduroy the approaches. The entire company, frequently at full strength, was continuously engaged in this corduroy work until it left Vaires at the close of January, 1871.

[1] "Brückenstege."

[2] "Laufbrücken."

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possible during their advance to the bridge site, especially as haste is requisite;

3. Appropriate measures during the work of construction.

RECONNAISSANCES.

Every river course noted on the map and lying either in the line of advance or on a flank must engage the careful attention of every pioneer leader. For, it may be confidently expected that problems of various sorts will await the pioneers at these obstacles. Everything should be done, therefore, without waiting for orders from the commander, to get information at a timely moment about the available crossings. The pioneer officer attached to a large cavalry command—the commander of the cavalry pioneer detachment, will be charged with the important duty of doing some preparatory work in this connection, and to see to it that his general reports in regard to all streams crossed by him are promptly sent to the rear and that they reach the higher pioneer commanders.[1] Of course, the information contained in these messages does not suffice. The messages simply furnish general information that enables bridge trains to be brought up, improvised material to be requisitioned, etc. When a bridge is ordered to be constructed, the detailed reconnaissance for the purpose should be made as soon as possible by the organization charged with the bridge work, when practicable, under the personal direction of the senior pioneer officer charged with the bridge work.

Speaking generally, the terrain to be reconnoitered can not possibly be reached soon enough. One should not hesitate to make even long rides at night, if by making them, the reconnaissance proper can be begun at daybreak. Night reconnaissances are, in general, of little value, but the presence of hostile forces may make it necessary to reconnoiter along the river

[1] Napoleon assigned one experienced engineer officer to each cavalry division. German pioneer officers did good work in a similar capacity in the campaign of 1870–71. Lieutenant Neumeister, Xth Army Corps, for instance, crossed the Moselle with a strong cavalry patrol after an advance of 60 km., being one of the first to do so, destroyed important telegraph lines on the hostile side of the river and ascertained that it was still spanned by three intact bridges, of which fact the supreme command had until then been in total ignorance. An experienced captain of pioneers is, by the way, at present attached to each French cavalry division, another pioneer officer commanding the cyclist pioneer company.

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bank or on the hostile bank during the hours of darkness only. It may sometimes be possible to reach the river by means of motor cars and then to get mounts from the cavalry for the reconnaissance.

In many cases, the patrols pushed ahead must first clear up the tactical situation under which the crossing will have to be made. The general situation and reports brought in by the cavalry and aircraft will, to be sure, give some idea as to whether resistance may be expected on the river and as to the character of that resistance, but more definite information will not be obtained until reports are received from the patrols sent forward to make special reconnaissances. In these reports, every bit of information that is not in accord with the supposition under which the patrol was despatched, is important. In case the patrol unexpectedly encounters strong hostile forces, prompt report should be sent back of that fact in order that the commander of the troops may be enabled to issue his orders in time to meet the changed situation. But information to the effect that the point on the river bank where the enemy was expected is unoccupied is much more important. Prompt report is especially necessary in this case, to enable the leader to throw troops across and thus to take full advantage of the golden opportunity unmolested and at once to effect a crossing that perhaps later on would have to be forced in face of the enemy. To be sure, such reports must be absolutely trustworthy, as they may induce the superior commander to come to a decision having far-reaching consequences. To this end, patrols should, in the first place, thoroughly investigate conditions on the far bank of the river; an energetic advance across the river is, therefore, absolutely requisite. While occupied in this task, patrols can simultaneously gather important technical information relative to the character of the river, the opposite bank, and the roads leading away from it. Cases in which patrols have to observe a certain amount of caution in crossing the stream, will be discussed later on.

Patrols should, in no circumstances, allow their investigations to be delayed by posts pushed across by the enemy to the attacker's side of the river. If they are not strong enough to cope unaided with such hostile posts, steps must be taken to bring up stronger forces (cavalry and cyclists). The superior

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commander is not likely to be grateful to the pioneers if the reconnaissance incidental to a crossing that is perhaps to be effected with celerity is retarded, because they failed to call upon other arms for assistance as soon as it became evident that unaided they were not making adequate progress.

Many erroneous opinions are prevalent in regard to the strength of pioneer reconnaissance patrols. During one of the larger pioneer exercises, a pioneer officer of high rank, accompanied by only one young officer and a mounted orderly rode from 25 to 30 km., and reconnoitered a broad stream for a crossing. The lieutenant's horse soon played out and so—there is no use mincing matters, the two other riders wandered aimlessly up and down stream without getting results, without giving directions to the pioneers and bridge trains that were meantime approaching, and without taking any requisite measures nor issuing necessary orders. Chaos was the result, primarily because of the entirely inadequate strength of the reconnoitering patrol. Such patrols should be strong and should consist of several officers, non-commissioned officers, and men, the officers mounted, the non-commissioned officers and men transported on wagons. Bridge wagons of the new division bridge trains are well adapted for such transportation. In case of necessity, other vehicles or bicycles should be requisitioned.

The bridge wagons also carry means for quickly throwing a patrol across a stream. When such wagons can not be sent along, or when the proximity of the enemy precludes the use of pontons to ferry patrols across, the patrols should at least be equipped with life preservers and raft sacks (*Floszsäcke*), which can easily be carried on the horses.

The attention of pioneer patrols is completely occupied by the object of their reconnaissance in this case as well as in others to be discussed later. If they are obliged to take care of their own security, the thoroughness of their reconnaissance will, without doubt, suffer. It is, therefore, a good plan, to place a cavalry detachment at their disposal. This will brush aside weak opposition and protect the pioneers during their work. Cavalry detachments detailed for such duty should be particularly circumspect in their conduct when secrecy of the reconnaissance operations is necessary.

In general, the orders given the pioneer commander will

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clearly specify approximately where the bridge is to be constructed. This relieves him from making any tactical estimate as to the location of the bridge site, and technical considerations will predominate. The importance of good roads to and from the bridge has already been mentioned and nothing but matters important for the bridge construction proper and familiar to every pioneer officer, remain to be discussed, viz., width and depth of the stream, velocity of its current, character of its banks, placing improvised material in readiness, etc.

The decision as to where and how the bridge should be built, and whether there will be time enough to do the maximum amount of preparatory work before arrival of the pioneer unit, depends upon the proper estimate of all the conditions encountered.

The procurement of material retards the building of improvised bridges in war, according to experience, to an extent little appreciated in time of peace. Here is where even a handful of men arriving early at the bridge site can do a great deal of preparatory work before the pioneer unit arrives. They not only determine what local material is available, locate blacksmith shops, builder's yards, and hardware stores, requisition wagons and teams, have staples and spikes made, etc., but begin, if practicable, with the aid of the local inhabitants, to bring the material (even river boats, power launches, etc.) to the place where it is to be used. The threat to impose a contribution on the community, or to tear down the mayor's house to obtain bridge material, will, even in hostile country, put many people in motion to get together whatever material may be necessary. To be sure, energetic officers, non-commissioned officers, and men are needed to supervise the businesslike and prompt execution of the orders given. If the locality is reached soon enough, a community may even be directed to begin repair work independently, but under proper supervision, on destroyed bridges, and to build ramps, approaches, etc.[1]

Bridges are frequently built at night. But it is practically impossible to construct improvised bridges quickly at night unless building material is found available and sufficient illu-

[1] During the campaign of 1796, Napoleon directed the communities on the Tanaro to rebuild, within three days, all the flying bridges that had been destroyed by General Colli in his retreat. The task was completed to Napoleon's entire satisfaction within the time set.

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mination is provided for the work. The reconnaissance patrols should invariably ascertain whether adequate stores of material are available in the locality.

Simple expedients suffice to determine the width of the stream, the velocity of its current, and the profile of its bed. This information then serves as the basis for an accurate, detailed division of labor, and for an estimate of the amount of material required.

It will be a good plan, in all cases, for the patrol to make arrangements for subsisting, billeting or bivouacking their units before they arrive. In any event, it is desirable to quarter the pioneers as near their work as possible.—If, in addition, the patrol determines where covering detachments should be posted, plants signposts indicating the road to the new bridge and establishes communication with the approaching organization, adequate preparations will have been made for the construction of the bridge.

It will be seen that a reconnaissance patrol has plenty of problems to solve and can cope with them only if its strength is adequate to its task.

THE ORGANIZATION AND ITS BRIDGE EQUIPAGE.

It depends entirely upon the situation and the orders issued as to when the pioneers move out to tackle their task. It is always desirable for them to arrive at the bridge site as soon and in as good condition as possible, and to begin bridge work promptly after getting a meal and resting as long as the situation permits. Like the commander of the 1st Company, 11th Pioneer Battalion, mentioned above, any leader whose company has to make a long march to reach the bridge site, should see to it that at least a part of his men as well as those of infantry supports that may be attached, and their packs, those of non-commissioned officers, at any rate, are carried on wagons. Building operations will be materially accelerated even if only 40 or 50 pioneers arrive at the bridge site ahead of their company. They generally suffice to attend to the preliminary construction work that usually takes up much time.

It may be well to give here a few practical hints, based upon experience, about utilizing bridge trains for the transportation of personnel and packs. In addition to their normal load, each

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of the three trestle balk and trestle wagons of the new division bridge trains can carry 50 knapsacks, inclusive of intrenching tools, and each of the 12 ponton wagons, 28 knapsacks. If the trestle balk and trestle wagons are to be used for transporting men only, all the packs of the company can be comfortably carried on the ponton wagons of the division bridge train. Each of the three trestle balk and trestle wagons can carry eight men for considerable distances. The new division bridge train can, without difficulty, transport 60 men and the packs of the remaining men of the company. For short distances (a few kilometers), and on level ground, 18 to 20 men were transported at a trot during maneuvers on each of the wagons carrying old model pontons, i. e., a company at full peace strength was carried on one division bridge train.

It has already been pointed out that, if a bridge is to be built quickly, as much service bridge equipage as possible should be placed in readiness and used in the work. It is likewise very desirable to have a few extra pontons available for life saving and guard purposes and in reserve. But when service bridge equipage is not available in adequate quantities, the pioneer commander will have to exercise considerable foresight in gathering material far and wide, and will sometimes even have to carry it along permanently.[1] The bulk of such material should consist perferably of boards, which are taken from the nearest lumber yard and carried along on light wagons. It is likewise desirable to procure and to carry along light beams, staples, spikes, wire, and rope, provided proper limits are not exceeded. But even more can be done. Simple hasty bridges that take up very little room, can be constructed and carried along by a pioneer organization for a time. Paragraph 439, F.S.R., permits such temporary transportation. To quote: "The trains may be temporarily increased . . . by commanders of troops requisitioning a few vehicles to transport service equipage, etc. Commanders taking such action will render a report thereof and will be held personally responsible that the practice does not lead to abuse."

At Wörth almost all of the pioneer companies arrived on the battlefield minus their tool wagons. These had been held back by commanders and had been unable to follow their units on

[1] See "Deutsches Offizier-Blatt," 1911, p. 1082.

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account of the bad state of the roads. The result was that the bridges over the Sauer had to be built without the service tools of the pioneers. The principle that there is just as little excuse for a pioneer company to become separated from its bridge train as for field artillery to become separated from its caissons, has been emphasized so often, meanwhile, that it is scarcely necessary to repeat it here. But that, in the future as in the past, a pioneer company may be forced temporarily to dispense with its wagons, is by no means precluded. When this happens, the company commander should follow the example set by General Eblé of the French Engineers during the retreat from Moscow. When Napoleon abandoned his bridge trains and used their teams to save his artillery, General Eblé had every pioneer carry some tools, etc., from the abandoned trains, in addition to his usual kit, and in this manner transported equipage that proved invaluable at the crossing of the Beresina.[1] In such emergencies, even horses may be made to carry pioneer equipment temporarily. Foreign armies, for example, have no tool wagons at all with their cavalry divisions, but carry all pioneer tools either on pack horses or on pack mules.

THE CONSTRUCTION OF THE BRIDGE.

I shall not attempt to discuss the type of construction—whether service equipage or improvised material is used, the kind of piers employed, etc. Every pioneer officer knows from experience how an appropriate division of labor can expedite the work. But the great importance of gathering building material for improvised bridges should be again emphasized. To be sure, in densely settled regions, timber, iron, power boats, etc., will be found in super-abundance, and advance patrols and detachments can begin collecting what is needed. Besides, the pioneer company will, as already stated, sometimes carry along improvised material; but, nevertheless, the troops themselves will upon arrival at the river often have to carry and haul the material needed. The rapid progress of the bridge work is, moreover, almost wholly dependent upon the timely arrival of the material. "The company commander[2] should, therefore, not leave the

[1] Napoleon should be given the credit for having suggested this measure.
[2] From comments appended to the report on one of the larger pioneer exercises.

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work of collecting material to his subordinates, but should supervise it himself. In this work, he will often encounter difficulties that will tax his resourcefulness to the utmost, whereas the bridge work itself, provided appropriate dispositions have been made beforehand and clear and definite orders have been issued, can be left to an experienced subaltern. In some cases, it may, likewise, be desirable to install telephone or cyclist communication between the place where the material is obtained and the bridge site, in order that accurate information may be obtained at any moment as to the amount of material on hand and the amount to be expected, and that changes in construction necessitated thereby may be made in time."

Foresight in procuring improvised material will likewise play an important rôle where service equipment is to be used in bridge construction. For, it is a cardinal principle that every bridge built of service equipment must be replaced as promptly as possible by one constructed of improvised material. Every pioneer officer charged with building a bridge should bear this in mind and make his preparations accordingly, primarily by procuring the requisite material. If this is neglected, neither the bridge train nor the pioneer company itself can be released and sent forward to rejoin the division, which, meanwhile, is earning laurels on the battlefield and sorely misses its pioneers, who are supervising the passage of field and divisional trains over their service bridge.

For an example of crossing a service bridge, see the chapter on "Rear Guard Actions on River Lines."

II. ACCELERATED CROSSINGS IN THE IMMEDIATE PRESENCE OF THE ENEMY.

EXAMPLE.

The following situation developed during a maneuver (see Fig. 2):

The Reds occupied a position on the right bank of a river about 40 m. wide, their left flank resting at *A*. The Blues had deployed opposite them, with their right flank resting at *B*. As the stream made a further advance impossible, it became necessary to gain possession of the bridge at the village *C*. This bridge was held by one Red company posted in an excellent

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position. Artillery could not be brought to bear effectively against *C*. A Blue detachment consisting of one battalion of infantry, some cavalry, and one pioneer company with division bridge train, therefore advanced carefully under cover on village *D*, with the object of driving out the hostile company. During a halt, a detachment of pioneers and infantry to be thrown across, was assigned to each wagon of the bridge train. The train then moved at the trot, infantry and pioneers running alongside the wagons, toward the nearby river. Upon arrival

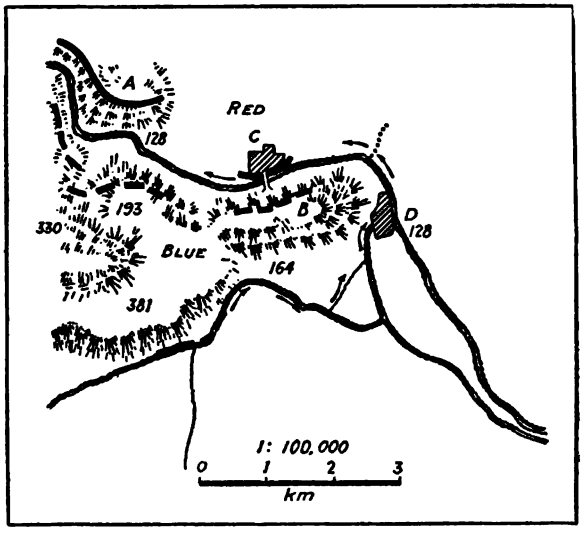

Fig. 2.
Accelerated Crossing.

there, the pontons were quickly unloaded and in a very short time the first detachment of infantry was on the right bank. The infantry battalion and a few cavalrymen were soon ferried across without receiving a single shot. Completely surprised by the advancing infantry, the hostile company at *C*, without offering serious resistance, evacuated its position, which was now also entered from *B*.

GENERAL.

The situation described in the foregoing example, requires that a golden opportunity be quickly seized and that a river in

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immediate proximity of the enemy be crossed practically in route column at a point on which the enemy had not as yet focussed his attention, and where he could seriously interfere with the passage if he were apprised early enough of the projected or actual operation. Operations like this can be undertaken either in the daytime or at night.

Such situations arise with special frequency in pursuits and during or after engagements. If promptly utilized, they furnish a commander the easiest solution of the seemingly difficult problem of crossing, while producing a very discouraging effect on the enemy, who believed the stream would protect his position or his retreat.

The crossing of the Saale by parts of Goeben's Division during the engagement of Kissingen,[1] fits the situation described almost exactly, but was not selected as an illustration because an intact foot bridge was used in that instance and the operation did not require the building of a new bridge over a stream, as contemplated in this discussion.

Everything depends upon celerity of execution. Therefore, don't reconnoiter too long and waste valuable time in preparation but act with decision, energetically push troops and bridge

[1] During the attack on Kissingen (see Fig. 3), on July 10, 1866, it developed that that strongly garrisoned place was prepared for defense and that the principal bridge was barricaded. The other bridges were partially demolished.

Since an assault against the bridge would, without doubt, have entailed heavy losses, it was obviously desirable to cross the Saale, which was only 20 m. wide, either above or below Kissingen and to force the evacuation of the city by a sudden flank attack. The division commander, General von Goeben, accordingly ordered Wrangel's Brigade to cross the river "somewhere, no matter how," and to attack Kissingen by enveloping it. Neither pioneers nor bridge trains were at hand for the crossing, and the infantry was thrown upon its own resources. But as luck would have it, the commander of the battalion that arrived first, discovered a superficially demolished bridge without deck, 500 m. below the town in the vicinity of the Linden Mühle, and the leading company at once clambered across one by one. The bridge was then partially repaired by infantrymen but permitted a crossing in single file only. The enemy made no move to throw back the troops so unexpectedly appearing on his side of the river. The Prussian forces near the Linden Mühle meanwhile grew steadily until they were strong enough to attack Kissingen on the left bank of the Saale, thereby forcing the enemy to evacuate that city. (For details, see Cardinal von Widdern, "Gefecht an Fluszübergangen," p. 38 et seq.)

A very similar situation existed during the engagement of Villersexel, where the principal crossing over the Ognon was forced from the rear by gradually throwing troops across by means of a footbridge that was found below the city.

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equipage to the river and at once throw troops across, or, if necessary, begin at once with bridge construction before the enemy has time to reflect or to take counter-measures. The best protection of the operation lies in boldness and celerity.

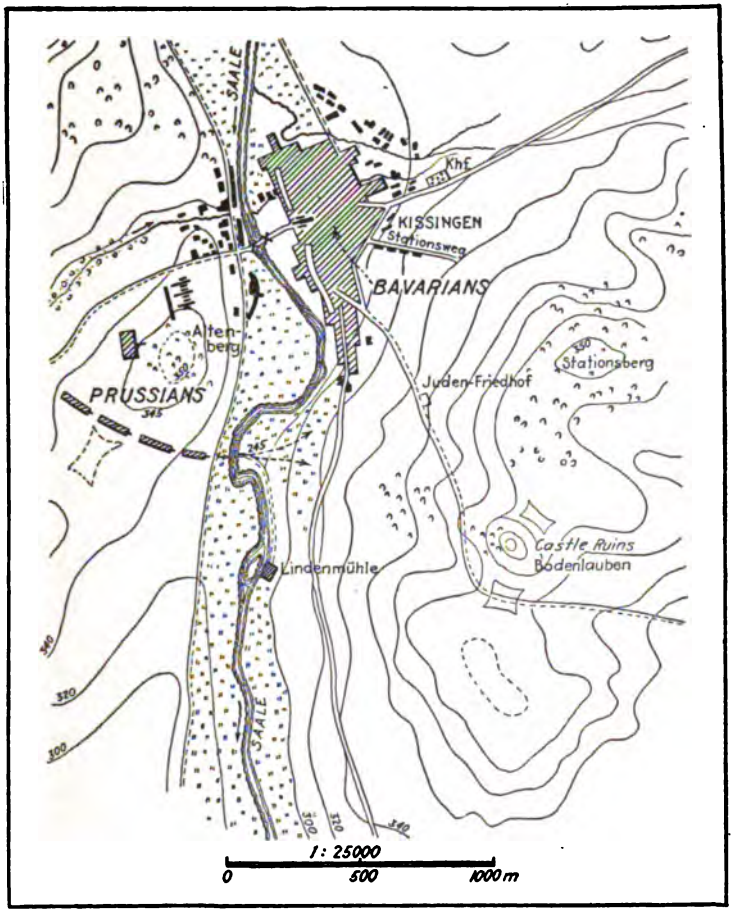

Fig. 3.

The situation is similar but much more simple when both forces are advancing toward a river and one reaches it before the other does. In that case also, the best solution is to take advantage of the start gained by very promptly throwing troops across. This operation must frequently be continued until the

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bridge, the construction of which begins at the same time and goes on simultaneously therewith, is completed, and which must be thoroughly protected from interference on the part of the advancing hostile forces.

Strong cavalry pushed ahead with pioneers will sometimes find itself in such a situation, but in that case, it is desirable to have infantry at the crossing point as soon as possible. It is still better when infantry (say either as cyclists or on wagons) accompanies cavalry charged with a crossing of some magnitude, and covers the crossing and later on serves as support for the advancing cavalry. While performing these duties, this infantry can clear the opposite bank of small hostile parties and keep it clear of them, in order to enable the following troops to negotiate the crossing under the easiest conditions.

DETAILS.

A few details that merit attention in the first described situation will now be presented. No difficulty will be experienced in arriving at proper conclusions in the last described and more simple situation.

The crossing point should be tentatively selected from the map and should be so located that it can be reached without making an unduly long march. In addition, it should not be too far from that point on the opposite bank, against which the attack is to be directed. When these conditions can not be fulfilled, the attacking troops will lose too much time in marching and the prospects of surprising the enemy will be correspondingly diminished. A good road, practicable for vehicles of the bridge train and affording concealment for the advance to the river bank, is always of decisive importance.[1] If troops are compelled to march for miles in order to reach the crossing point, all prospects of surprising the enemy vanish, and the success of the whole operation becomes doubtful.

The character of the river itself, and the nature of its banks usually play only a subordinate rôle in the crossing. If troops equipped with sufficient bridge equipage have succeeded in reaching a river without being discovered by the enemy, they will also manage to cross it. The troops will gladly put up with

[1] Short stretches of road that are not concealed from the enemy's view, can often be screened by masks.

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all kinds of difficulties and hardships incidental to the crossing, provided they know that victory awaits them on the other bank. To find a crossing point against which the enemy will not be able to bring his artillery to bear at all, will be possible in very exceptional cases only. It is usually sufficient to pick out a crossing point that is concealed from the enemy's view. It is undesirable to cross opposite villages, farms, etc., as they appear to exercise a special attraction on hostile patrols. Besides, a crossing at such points is apt to be easily discovered and frustrated.

The reconnaissance preparatory to accelerated crossings *in the daytime* proceeds quickly and simply. A resourceful pioneer commander who anticipates the wants of the troops will have gathered information, before he gets orders to initiate the crossing, as to the character of the water-course to be crossed. In the execution of the task itself, it is, as a rule, of more importance to select the most favorable crossing point in the vicinity of the locality indicated on the map, than to examine long stretches of river to find the best crossing point. For this reason, it is wholly unnecessary to send out a large number of patrols. Usually it is sufficient to send out an experienced officer—say the commander of the pioneer company coöperating in the undertaking, who, accompanied by several men, makes the reconnaissance. But this patrol should keep one thing in mind, viz., that it must accomplish its mission not only rapidly but as secretly as possible. Once the enemy's suspicion is aroused, the prospects of a successful termination of the operation are materially reduced. It is, therefore, incorrect, as a rule, to make a special reconnaissance of the hostile river bank. One must rely on the map and on the general impression produced by the terrain and let the troops that cross later on make the best of whatever conditions they find. If there are serious doubts as to whether the opposite bank is actually free of the enemy and passable, it is desirable to make a reconnaissance (and detailed examination by men who swim across) to ascertain the facts. This reconnaissance should immediately precede the crossing, but should not delay that operation itself.

The results of the reconnaissance will reach the commander of the troops and the organizations charged with the crossing operation, either while they are advancing toward the crossing

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point, or at a rendezvous point from which a choice of roads for reaching the river is still possible.

Meantime, the few preparations necessary for an accelerated crossing will have been made by the troops. As a rule, a pioneer company or battalion and a number of bridge wagons will have been assigned to the organization directly charged with the crossing. The preparations simply consist of assigning to each wagon a number of pioneers as ponton carriers and drivers (a total of 20 to 22 men under a non-commissioned officer), and the first load of a ponton (not to exceed 18 infantrymen). They march alongside or directly in rear of their wagon, the men detailed to row carrying their oars; distances between wagons are increased. When there are not enough pioneers for carrying the pontons, infantrymen are detailed to assist. The column, protected in front by a suitable covering force of infantry, marches in this formation under cover until the river is reached. The last available cover is utilized for a short halt and rest, during which pioneers and infantry attached for their support discard packs, and responsible leaders quickly orient themselves, when this can be done without loss of time and without betraying the operation to the enemy, as to the route that should now be followed. The march is then continued (wagons moving, if practicable, at the trot) to the river and the latter approached as closely as possible. Each crew finally unloads its ponton, carries it to the river, and ferries a load of infantry across, returning at once for another load. Reinforcements that have arrived meantime are assigned to the various pontons in rotation as they return to the friendly bank. It is desirable to post infantry detachments on the flanks of the crossing point immediately before the crossing begins. These detachments keep down the fire of suddenly appearing hostile forces, but avoid all unnecessary firing so as not to draw the enemy's attention to the crossing.

Once some troops have been thrown across, the first initial success will have been gained, and it will then be entirely up to the commander of the pioneer company to see that the crossing of the troops is continued as rapidly as possible and that, if requisite, a bridge is thrown across. Detailed rules as to the procedure to be followed can not be given. They will depend upon the terrain, the tactical situation, the available bridge

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material, etc. As a general rule, however, it will be necessary to establish ferry service, to convert pontons into cavalry ferries for transporting horses, to initiate the bridge work, etc. To issue orders in regard to all of these details and to start things going does indeed make great demands upon the energies of the commander of the pioneer company and it is a sure sign of the sound training of a company if it is able to solve the manifold problems that now confront its individual members.

When instead of a ponton, hasty bridges of any kind are to be utilized, considerable time must, indeed, be spent in preparation. But a certain amount of caution is requisite. As enticing as the idea of quickly throwing an improvised bridge over a stream 60 to 70 m. wide may be, such bridges are usually of the lightest improvised construction, often break down, especially when they span wide streams whose current is swift, and are not absolutely dependable. Ponton ferry service is by no means used as often in practice as it might be, though it can be established very quickly over streams not over 40 m. wide.

The example cited illustrates an accelerated crossing skilfully and effectively executed in broad daylight in the immediate presence of the enemy. The conditions are frequently much easier and like those in a crossing outside the effective zone of the enemy, when a small force contains the enemy and endeavors to deceive him as to the real point of crossing, while the bulk of the force marches to a distant point on the river, ferries covering troops across without being observed by the enemy, and constructs a bridge under their protection. The operation is similar to that described in the example given below, of a crossing effected at night.

The cavalry masses in advance will, in general, endeavor to cross a river in territory outside the enemy's zone of operations and, after effecting a crossing, exert pressure upon the enemy from a flank.

ACCELERATED CROSSINGS AT NIGHT.

Example.

During the Imperial maneuvers at Minden in 1898, a situation arose that made an accelerated crossing and bridge construction at night necessary. (See Fig. 4.)

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On September 7th, a Red (Western) Corps (VIIth Army Corps, consisting of 4 divisions) retired before a Blue (Eastern) corps (Xth Army Corps, consisting of 4 divisions) on Minden, had reached the left bank of the Weser with the bulk of its forces,

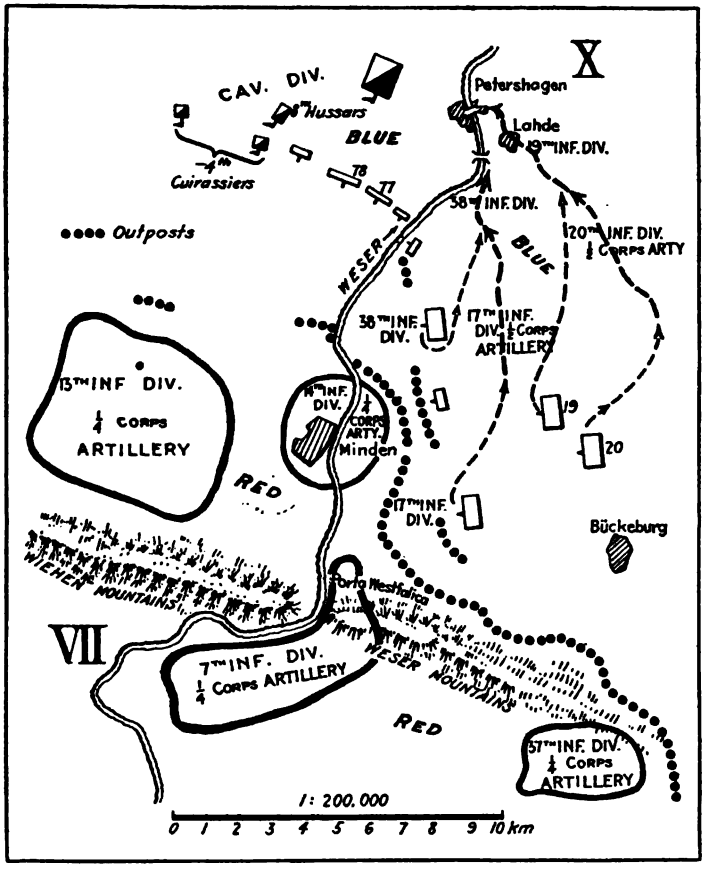

Fig. 4.

Accelerated Crossing north of Minden.

and held the bridge head of the suburb of Minden on the right bank of the Weser with small detachments. Two divisions were compelled to withdraw behind the Weser Mountains. The Blue commander decided to let his cavalry division swim the Weser 15 km., north of Minden during the afternoon of

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September 7th, to let his four divisions cross below the hostile position during the night September 7–8, and to advance the following morning on the left bank against the hostile left flank. The pontons of two corps bridge trains had been launched unobserved by the enemy 15 km. north of Minden and were towed to Lohde and Petershagen after dark. Two infantry regiments (the 77th and 78th) arrived there at the same time and, toward midnight, were ferried across without any information thereof reaching the enemy. Bridges were likewise built at the same time at both crossing points. By 4 A.M., two divisions began to cross the completed bridges, and at 6 A.M., began their attack, which completely surprised the enemy and succeeded. The attention of the enemy had been diverted during the night by the attack that one brigade made against the bridge head on the right bank of the Weser at Minden and which was so successful that parts of the Red Divisions that had already crossed to the left bank, recrossed to the right bank and thus facilitated the success of the Xth Army Corps.

Details.

Reconnaissances incidental to accelerated crossings at night should, if practicable, be made during daylight. Special celerity is usually less necessary in such cases then secrecy. If it is desired to ascertain definitely whether the hostile bank is in reality unoccupied, that reconnaissance can best be executed by swimmers or men in disguise; or, immediately before crossing in some force, a patrol can be ferried across in a single ponton.

Special preparations need not be made, but it will often be a good plan to mark the approach with signposts and shaded lights. Pioneers should not be allowed to do any preparatory work at the river, such as prematurely placing in readiness boats, unloading bridge wagons, launching pontons, etc. All such preparations may prematurely attract the enemy's attention and cause him to take counter-measures. A single hostile outguard at the crossing point may jeopardize the entire undertaking. The aim should be to surprise the enemy completely by crossing at an unguarded and unobserved point. If a few pontons or ferries are in readiness, some troops should at once be thrown across without waiting for other means of transportation to be made ready. As in operations during the daytime,

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every encounter with the enemy should be avoided and the fire of isolated patrols should not be returned if it can be avoided. But infantry detachments posted on the flanks must be in readiness to fire upon hostile forces that appear unexpectedly.

Whether a bridge should be constructed after a crossing has been effected, and the site of such a bridge, will depend upon the situation. To make the crossing over a ponton bridge, which can be heard for miles at night, as noiseless as possible, the flooring should be covered with straw, manure, etc.

III. FORCED CROSSINGS.

EXAMPLE. (See Fig. 5.)

On January 20, 1871, during the advance from Gray to Pesmes, the 2d Company, 2d Pioneer Battalion, formed part of the advance guard of the 3d Infantry Division. The information that the bridge over the Ognon at *A*, at the southern exit of Pesmes, was destroyed, induced the division commander to bring up to the advance guard the light field bridge train marching with the main body.

The French had occupied the left bank of the Ognon, opposite Pesmes, with about two companies and endeavored to oppose a crossing there. The 1st Battalion, 2d Infantry deployed in the town and dispersed the French skirmishers on the river bank with its fire. Meantime, the advance guard battery had gone into position and forced the French companies to evacuate the group of houses at *B*, to which they had retired.

During the engagement, the ponton wagons had arrived at the river and had been unloaded. A rope ferry was quickly installed with the pontons—the river being about 50 m. wide at this point. As soon as one infantry company, which appeared to be sufficient to cover the operation, had crossed by means of this ferry, the construction of a bridge was begun.

Considerable difficulty was experienced in this, as the Prussian Sapper Company, which had only 7 (*sic*) pioneers familiar with bridge building, had to work with strange material, a combination of Mecklenburg and Hessian equipage. It took three hours to build the bridge, which was then at once used during the pursuit.[1]

[1] The crossing at Pesmes was a comparatively unimportant event. But it was a well initiated and skilfully executed forced crossing, and was selected

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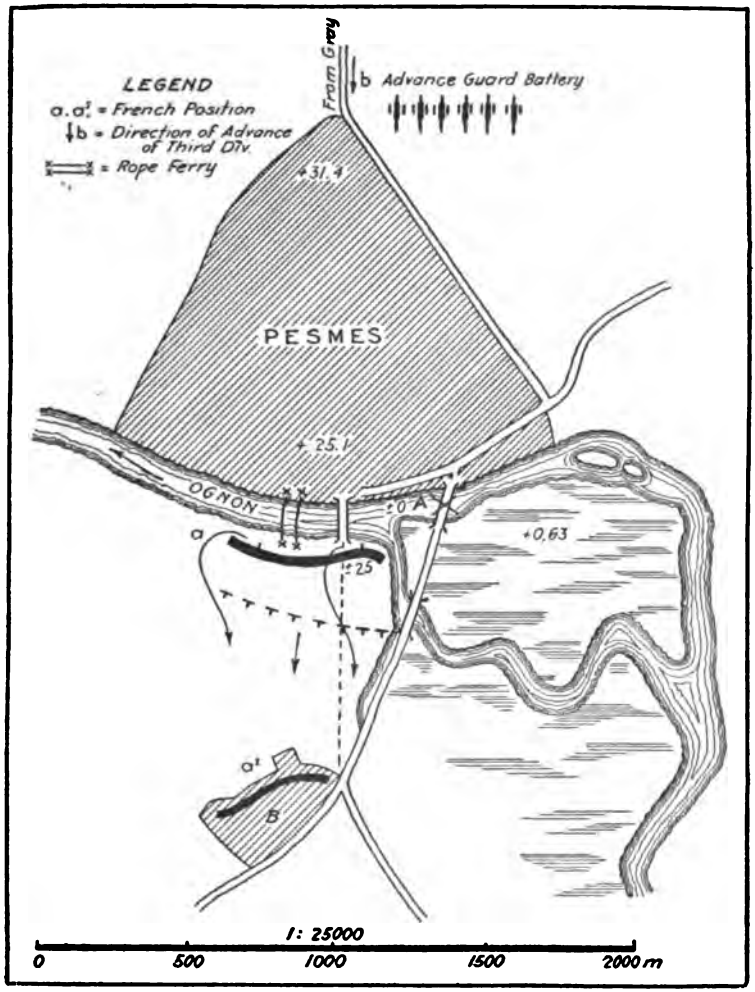

Fig. 5.

Forced Crossing at Pesmes.

as an illustration because all the details of it were available in definite form in the war diaries. Such forced crossings have, of course, also been made by large organizations. It is only necessary to recall the crossing of the Ist Bavarian Army Corps on September 2d, 1870, over the Meuse at Bazeilles. On that occasion, the Bavarian artillery so completely diverted the fire of the hostile artillery that the bridge work could be executed by the 3rd Genie Company without the loss of a single man.

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GENERAL.

In the example cited, force was the decisive factor. Surprise and celerity may enhance the prospects of success of such operations, but the characteristic factor of the crossing is force.

This method of crossing will undoubtedly be the best in case it becomes necessary to pass a narrow stream or one of medium width *during the daytime* in face of the enemy and without interrupting the advance. In such cases, this method may even be said to be the rule. In case of wide streams, a forced crossing during the daytime will only be considered when it is definitely known that the enemy's occupation of the opposite bank by means of patrols or isolated detachments is entirely inadequate. If there is any doubt in this regard, it is desirable to adopt the method described under IV as a "Surprise Crossing."

Hence, the crossing over a river that forms part of an occupied defensive position, in other words one that constitutes the obstacle in front of it (for example the Sauer at Wörth) will usually be forced. It will then be important for the defender to delay the attacker's advance, to inflict losses on him during the crossing or to utilize the weakness and confusion in the ranks of the attacking troops already across, for his own offensive. The attacker, on the other hand, will not allow the stream to delay his advance any more than he can help, and the simplest way of preventing any action on the part of the enemy, is to develop an overwhelming fire superiority.

Other situations that require a forced crossing, will occur when the attacker believes that the enemy from any cause, whether tactical or strategical, has desisted from offering resistance on the river line, using that line either as an advance guard or rear guard position only (see Fig. 6, *b*), or at a distance from the bulk of his forces, for posting detachments that can not count upon support. (See Fig. 6, *c*.) In this case also, the simplest expedient is either to break through or to crush the hostile line guarding the river and thereby to disappoint the enemy's hopes of gaining time.

The artillery, even the heavy artillery of the field army, naturally plays the principal rôle during this forced crossing. All of it should, therefore, be used, if necessary. When the

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artillery is posted on heights close to the river from which it commands the valley and the river, or, mayhap, a bend, the concave side of which is facing the enemy (see Fig. 6, *b*), such places are especially suitable for forcing a crossing. At the

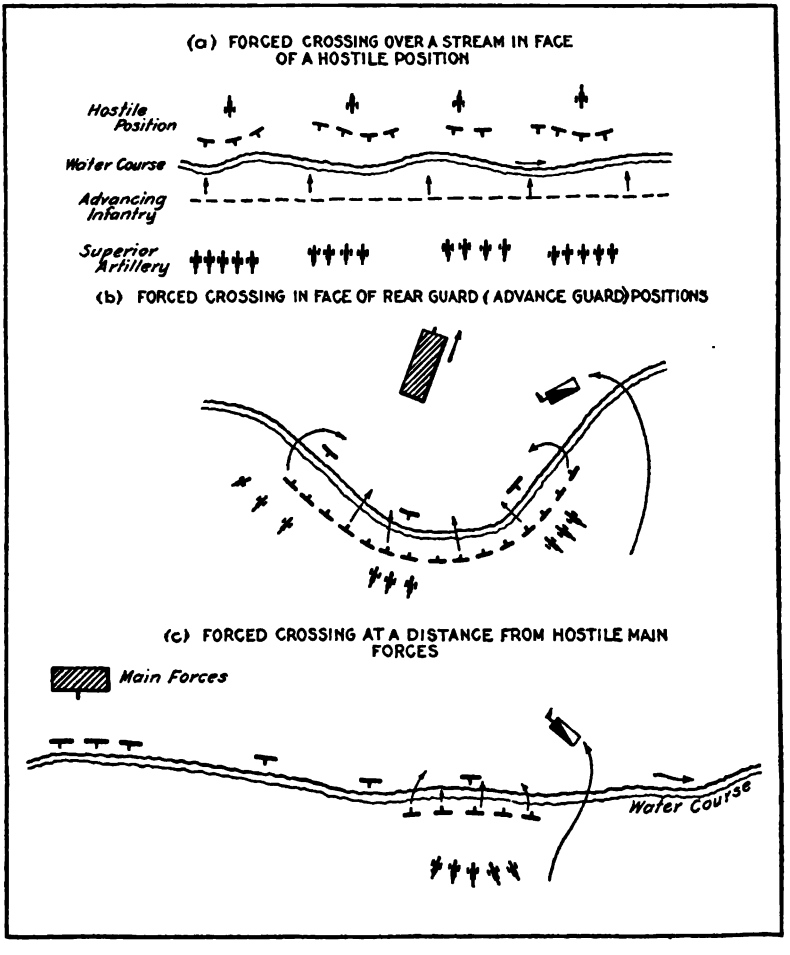

Fig. 6.

Yalu the Japanese carefully posted their heavy artillery in positions that enabled it to bombard hostile positions even across a wide valley. If the artillery can not find suitable positions,

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single guns and platoons may be drawn forward under cover clear to the edge of the river, provided the hostile opposition emanates from small infantry posts only. Even if they don't do much damage, they will at least produce a considerable moral effect. Their shields will afford ample protection against rifle fire.

But, it should be remembered that whenever the artillery opens up, the secrecy of the undertaking vanishes. Therefore, in crushing isolated hostile advance posts located on a river, if one desires to avoid attracting all the hostile forces in the vicinity and informing the hostile leader by the gun fire when and where the crossing was effected, one must perforce dispense with the coöperation of the artillery.

The infantry and its machine guns will usually advance to the river on a broad front and in combat formation, make a lodgment there, and then develop their full fire power. The pioneers arrive at the river with and under the protection of the infantry. They must make it possible to cross the river. Ferrying may often suffice, but the construction of light foot bridges or of more reliable bridges may frequently become necessary. For this purpose, service equipage may be used, but over narrow streams hasty bridges (Schnellbrücken) and light improvised bridges, the material for which can be carried more easily than heavy pontons, are especially suitable.

It is usually wholly undesirable to attempt to effect a crossing in mass at one point. Should a fairly strong hostile force be accidentally encountered on the opposite bank (as often happens in villages), the whole operation, in spite of our general superiority, may fail in face of the vigorous fire which we are unable to keep down. The most certain way to gain the opposite bank in a forced crossing is to advance to the river in numerous columns, if practicable, supplying every company of the first line with some service or improvised bridge material and the requisite pioneer personnel. Each company should then endeavor to cross as best it can with the means at its disposal, and after that is effected assist in breaking down such hostile resistance as is offered. In any event, however, subsidiary detachments should be thrown across on the flanks of the prin-

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cipal column. These should cross by means of the simplest expedients and advance against flank or rear of the forces defending the river line.

The drawback to this method is that the pontons of the bridge train have to be distributed over a broad front, which may make itself disagreeably felt later on when a bridge has to be built. But the most important thing is, after all, quickly to gain a firm foothold on the opposite bank, and the best method for accomplishing that is to cross with a number of columns. It will then be the duty of a skillful pioneer company commander and of his well trained organization to gather up the scattered pontons later on and to get them promptly and in time to the site of the bridge.

The cavalry should endeavor to gain the opposite bank as early as possible. Thanks to its mobility, it need not shirk detours, and can select points on the river that are either weakly guarded or not defended at all. It should cross either by swimming or by means of its own bridge equipage and may materially facilitate the advance of its own infantry by striking the defender in flank or in rear.

In case a cavalry division is charged with forcing a crossing independently, it should concentrate its artillery to the best advantage in order to be as strong as possible at the point of crossing. In crossing wide streams, the task of the cavalry will be materially facilitated if infantry (transported, when practicable, on wheels and motor cars) and bridge trains with pioneers (on the wagons) are attached to it.

DETAILS.

From the very outset, the whole undertaking must be permeated by force. Full use must be made of superiority in numbers and fire power to impress the enemy with our superiority. All reconnaissances should, if requisite, be carried out supported by strong forces, in order that any opposition may be promptly broken down. Otherwise, the reconnaissance is simple. The desire to force the crossing with as little loss as possible, not only permits, but requires that the reconnaissance be curtailed. It is primarily tactical in character. It must be determined whether the opposite bank is occupied and if so, how; where strong hostile forces are located; whether hostile re-

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enforcements are approaching, etc. In order to get this information, patrols should not only advance to the river, but should cross it and view things in rear of the hostile forces occupying the river line. The appearance of patrols in rear of a weak river guard will produce uneasiness and will facilitate the task of the attacker. Whereas the tactical reconnaissance is primarily the duty of cavalry, infantry or aircraft, and while the artillery should seek suitable positions from which it can cooperate, pioneer patrols should gather information as to the local conditions at the river (width, cover, approaches) and later on act as guides. In case pioneers are lacking (as for example at the Sauer during the battle of Wörth), the infantry, as a matter of course, takes charge even of their technical duties.

In case only service equipage is to be used for the crossing, preparations should be made for quickly unloading and bringing up of the pontons, by detailing detachments to accompany each vehicle. Hasty bridges usually require longer preparations. Attention has already been directed to the transportation of improvised material for light bridges. When the last cover is reached, and not later, the pioneers and their equipage are distributed among the infantry companies in case the river is to be crossed on a broad front.

To be successful, the execution of the crossing after thorough preparation by fire, requires usually only prompt and bold launching of the force and appropriate utilization of the available technical equipment. Care must be exercised that the wagons and teams of the bridge train do not leave cover until the fire of the enemy has been actually silenced. When necessary, the pontons are unloaded under the nearest available cover and carried from there to the river.

Although hasty bridges and other portable improvised material will often be used in crossing narrow water-courses, service equipment is more reliable both for throwing troops across (ferry service) and for bridge construction. The service matériel should, therefore, be held in readiness in the nearest available cover, in order that it may be quickly brought up as soon as conditions admit.

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IV. SURPRISE CROSSINGS.

EXAMPLE.

During August, 1799, some 47,000 Russians and Austrians were in position on the north and east banks of the Linth, Lake Zurich and the Limmat, defending this line against a French army of 60,000 men under Masséna, directly opposite them. Masséna wanted to defeat his opponents before they were reënforced by Suworoff. To accomplish this, it was necessary for him to cross the Limmat, which was strongly held by the enemy. After three weeks' preparations, this plan was carried out by suddenly throwing a strong infantry force across the river at daybreak on September 25th, and then building a strong bridge for the passage of the bulk of the army.

The Russian commander-in-chief played into the hands of the French in their undertaking by posting the bulk of his forces west of Zurich at a point about 9 km. from the crossing—leaving only 8,000 men to guard the Limmat (80–100 m. wide), from Zurich to its confluence with the Aar, about 2,000 men being posted at Weiningen (see Fig. 7) and 4,000 men 4 km. farther west. But, at the same time, he realized that the vicinity of Dietikon invited a crossing, and therefore, posted three battalions of infantry on a front of 1,800 m. to guard the river. These troops guarded the bank closely by posting sentinels and outguards.

The French gathered 37 roomy river boats for the crossing, capable of transporting 900 men at one trip. Sixteen additional pontons were to be used for constructing a ponton bridge. The 37 large boats were extremely difficult to transport. They were hauled about 200 km. overland by ox teams, and lay about 150 m. from the crossing point at Dietikon on September 24th. The pontons for the bridge were likewise brought to Dietikon in time. From the middle of September on, vigorous demonstrations were made at Gebensburg and Brugg (about 14 km. northwest of Dietikon), to make the Russians believe that a crossing was contemplated there. During the night of the crossing, the 37 boats were carried close to the river by about 1,000 men, and the crews with their implements took position directly in rear of them. The wagons with the bridge equipage stood under cover at Dietikon awaiting orders to advance as

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soon as bridge work was to begin. "With this, the arrangements were completed and the preparations for building the bridge so thoroughly made, as perhaps in but few other cases." (*Clausewitz.*)

The infantry was to cross in three columns, its leading elements arriving silently about 4 A.M. at the boats. A section of pioneers was attached to each column to remove obstacles on the right

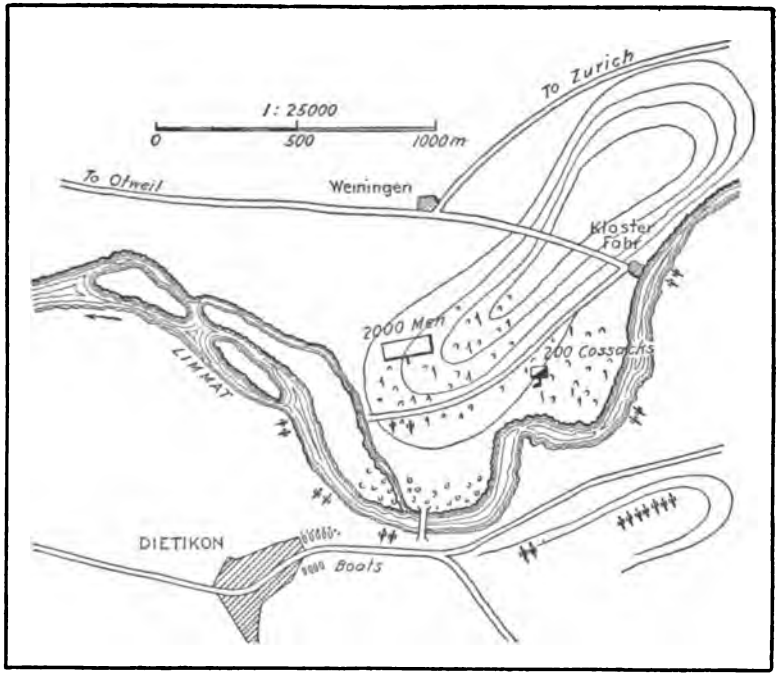

Fig. 7.
Crossing at Dietikon.

bank. The troops began to cross at 4:45 A.M. The movement was at once discovered by the enemy, who simultaneously opened fire. Nevertheless, the crossing proceeded with great energy, while 32 French guns posted on a wide arc, brought an enveloping fire to bear on the hostile bank, the French infantry deployed on the near side of the river also taking a hand in the fight. After three minutes, 900 men had been landed on the hostile bank and by 7:30 A.M., 8,000 men were across. As

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soon as the second echelon of the covering troops had reached the opposite bank, orders were given to begin the bridge, and the bridge train was brought up at a trot. No special difficulties were encountered in building this bridge, which was completed in two and one half hours, and by 9 A.M., 15,000 French were across.

GENERAL.

Masséna's crossing of the Limmat is a model even today. One need only to study it thoroughly in all its details to get an accurate idea of what to do and what to avoid in surprise crossings. The preparations for the crossing at Alsen in 1864 were made with equal care and foresight. The complete success of this operation confirmed the lessons taught by the crossing of the Limmat and gave us an experience in such difficult undertakings, which has since been formulated and laid down in our regulations. Besides, surprise crossings of magnitude, as already stated, play a considerable part during our annual pioneer maneuvers and we learn so many valuable lessons from them that it may, perhaps, be presumed that we have gained an accurate conception of all the tactical and technical problems incident to such operations. They shall be discussed in the following pages in more detail than is possible, in the nature of the case, in our regulations.

VARIOUS KINDS OF SURPRISE CROSSINGS.

Secrecy of the preparations and the endeavor to leave the enemy as long as possible in the dark as to the crossing point, always characterize every *surprise crossing* operation. The preparations are made *at night*. Surprise crossings may be initiated in exceptional cases in the daytime, only in case extensive forests, fog or rain afford complete concealment from the enemy's view.[1] One goes to the trouble of making preparations for a surprise crossing and does not choose the simpler methods described under I and II, in case one has ascertained, or is compelled to assume, that the enemy is carefully guarding the

[1] During the crossing of the Danube preceding the battle of Wagram, the islands in the river permitted floating equipage to be collected under cover during the daytime and to be placed in readiness in the form of flying bridges. In view of the aircraft of the present day, the value of such cover is considerably reduced.

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river for the purpose of opposing the crossing and allowing the bulk of his forces time to come up to the counter-attack. The necessary secrecy of the preparations occasions the loss of a certain amount of time, which must perforce be accepted as it is unavoidable in all surprise crossings. It is only in crossing wide, unfordable streams that greater difficulties are encountered;

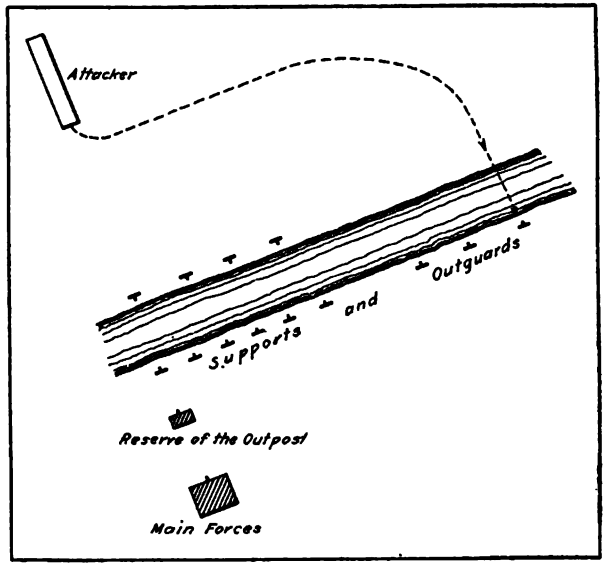

Fig. 8.

Turning the Hostile Main Forces.

it is consequently in their case only that a careful guard will be profitable, and that surprise crossings, in the sense in which that term is employed here, will become necessary.

(*a*) *Turning the Hostile Main Forces.*

The surprise will be most complete if one succeeds in crossing the river outside the effective zone of the hostile main forces, perhaps at a point but weakly guarded. (Fig. 8.) The method used is similar to that employed in an accelerated crossing (II), but, on account of the width of the stream and the possible occupation of the hostile bank, careful technical preparations are

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made with great secrecy. These consist of placing river vessels in readiness under cover of darkness for the first crossing of troops, which is effected frequently at one point only. Aside from this, one should always make an attempt to evade the hostile main forces, provided the general situation admits. When this is done, faulty selection of a crossing point, mistakes made by the troops in crossing and technical shortcomings

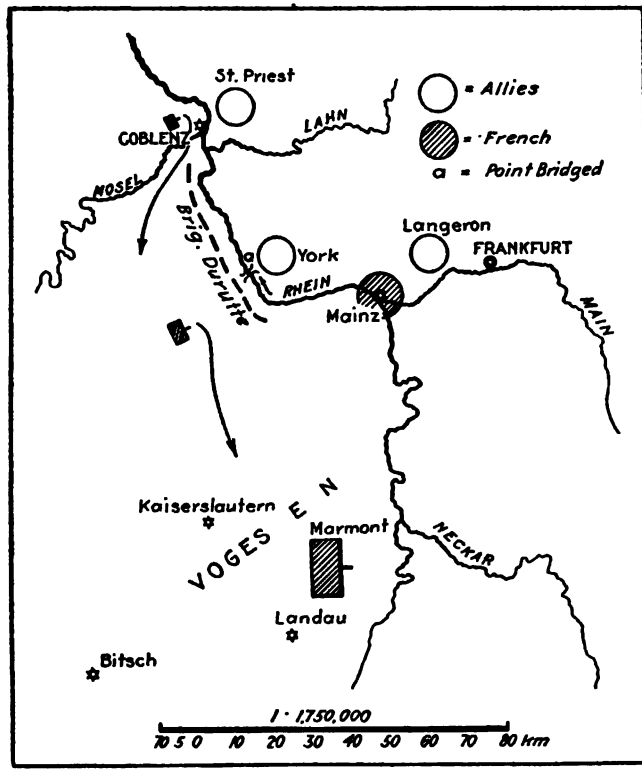

Fig. 9.
Crossing at Caub, Situation on Dec. 31, 1813.

adjust themselves most easily and the harmful consequences are reduced to the minimum. The troops will, however, have to march considerable distances, as a rule, to reach the crossing point. But the great risk of crossing a broad stream in face of the enemy is avoided. Neither Blücher's crossing of the Rhine

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at Caub[1] (see Fig. 9), nor Napoleon's crossing of the Beresina (see Fig. 24) could ever have succeeded in face of strong hostile forces, in view of the wholly inadequate technical preparations.

It goes without saying that the attacker, after his turning movement has succeeded, must utilize infantry and artillery fire to the extent necessary to break down whatever hostile resistance is encountered. But, as already stated, all fire, particularly that of artillery, quickly attracts the enemy's attention and should, therefore, be used with caution when action by the hostile main forces is to be apprehended.[2]

(b) *Frontal Attack against Hostile Covering Forces.*

The tactical situation, however, frequently demands that the very opposite of such cautious and time-consuming procedure be employed. (See Figs. 10 and 12.) When a weak incompletely organized defense of a river line is to be quickly crushed, for example during the pursuit of a defeated enemy who makes a stand on the opposite bank, or when a river is to be crossed on a particular front in order that operations may be continued on the other bank in a direct line and without material detours, a frontal attack of the hostile position is, in many cases, the proper procedure. The character of the terrain and neighboring troops, whose presence makes flank movements impossible, will, likewise, often make this necessary.

[1] At the close of 1813, the concentration of the French forces pushed forward to the Rhine in a thin cordon had already begun as directed by Napoleon. Thus it happened that, about the time of the crossing at Caub (January 1, 1814), Mayence alone was still occupied in force, other strong French forces being in the Palatinate. The weakness of the French covering forces and the belief that they would not anticipate a crossing at Caub, induced Blücher to throw York's Corps across at that point, although the locality offered considerable difficulties to bridging and the narrow roads and rocky character of the terrain would have been a great disadvantage, if the crossing had been seriously opposed. At 2:30 A.M., January 1, 1814, the infantry began to cross, under cover of 2½ batteries posted on the heights overlooking Caub, and of 2 guns posted on the river bank within the line of the covering infantry. Nothing but small hostile posts were encountered. By 8 A.M., 6 battalions had crossed to the left bank of the Rhine. The construction of the bridge was greatly retarded by inadequate matériel, which consisted of canvas pontons and light anchors, and was not completed until January 2.

[2] This method of crossing is discussed in a very readable essay in the *Kriegstechnische Zeitschrift*, 1901, p. 62, *et seq.*, under the title, "The Crossing of the Schlei, 1864."

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The methods employed in crossing streams under these assumptions differ according to the value placed upon force (Fig. 10) or upon surprise (Fig. 12).

1. *Surprise-Forced Crossing.*

In a surprise-forced crossing, the preparations, especially the advance to the crossing point, should proceed with absolute secrecy. Once arrived at the river, however, all secrecy should

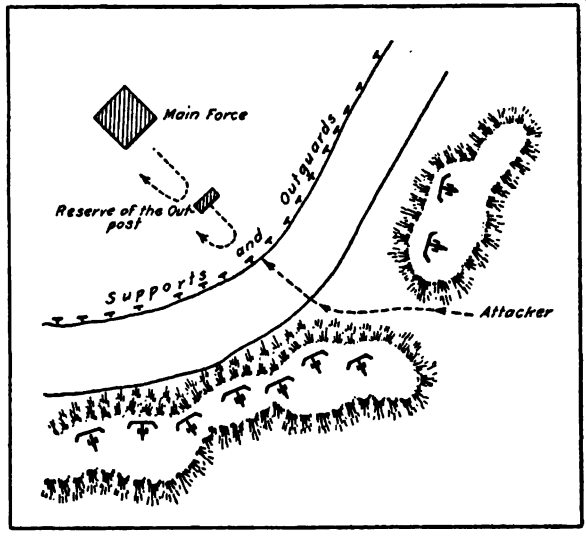

Fig. 10.
Surprise-Forced Crossing.

be discarded and the crossing forced in broad daylight with the coöperation of the artillery.[1] This procedure is feasible only if the attacker's artillery from a position close to the river commands the opposite bank far and wide so effectively as to sweep it clean of all hostile covering forces and so as to keep all hostile reinforcements, which on their part, will not find good artillery positions in the river bottom, at such a respectful distance that the attacker's troops, after crossing the completed bridge, can deploy with ease. But, the effectiveness of artillery should not be overestimated. A well prepared defender may

[1] The principal Japanese crossing of the Yalu in 1904 may, perhaps, be considered a surprise-forced crossing.

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have thrown up effective cover on the river bank, or may have occupied strong supporting points, such as villages, which, according to experience, the artillery, unaided, can not compel him to evacuate. Besides, dummy trenches may divert its fire and timber along the banks impair its effect. Moreover, fog, very prevalent in wide river valleys, or rain may entirely nullify the effect of artillery fire.

On the other hand, artillery can bring its full powers into play only during a crossing effected in the daytime. All counter-attacks of the enemy are shattered by its fire. As interruptions need not be feared, the construction of the bridge can proceed in peace and checks do not entail such grave consequences as where minutes are precious in case troops thrown across are hard pressed and must be quickly supported.

The whole procedure resembles that of a forced crossing described above (III). But in a forced crossing, the cards are laid on the table from the outset, and even the preparations are made in the open, because so little is thought of the resistance likely to be encountered that deception of any kind is not deemed worth while. The width of a stream is usually the factor that makes turning movements or secret preparations at night necessary.[1]

[1] Before the battle of Wagram, Napoleon decided to make a surprise-forced crossing of the Stadlau arm of the Danube, which still separated him from the Austrians. (See Fig. 11.) He made his preparations for this during the day and, contrary to modern views, executed his design during the night.

In June, 1809, he had caused numerous bridges to be constructed south-east of Vienna, connecting the right bank of the Danube with the islands located there, only one arm, 120 m. wide, remaining to be bridged. Ample matériel for ferrying troops across and for bridging was deposited on the Island of Lobau itself and on the right bank.

After making a feint opposite Essling on July 1st, which induced the Austrians to occupy the apparently threatened point, Napoleon suddenly assembled a strong force on July 4th on the Island of Lobau, which had been strongly intrenched during the preceding weeks. Toward 10 P.M., numerous French batteries directed a violent fire upon the Austrian positions and intrenchments along the river bank, Grosz Enzersdorf being soon in flames. After firing had continued for a short time, French infantry was thrown across. As soon as it had made a lodgment on the opposite bank and had been sufficiently reinforced, the construction of a number of bridges was begun and, thanks to the excellent preparations, they were completed so quickly that by the morning of July 5th, 9,000 French were on the left bank of the Danube. (For a more detailed description of the operation, see "Mitteilungen über Gegenstände des Artillerie und Geniewesens," 1912, p. 1279.)

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2. *Surprise of the Hostile Covering Force.*

Such an energetic procedure, that of forcing a crossing, will be fully justified in many cases. It harmonizes best with the confidence born of the superiority of the attacker, who will but unwillingly avail himself of all kinds of tricks and ruses in order

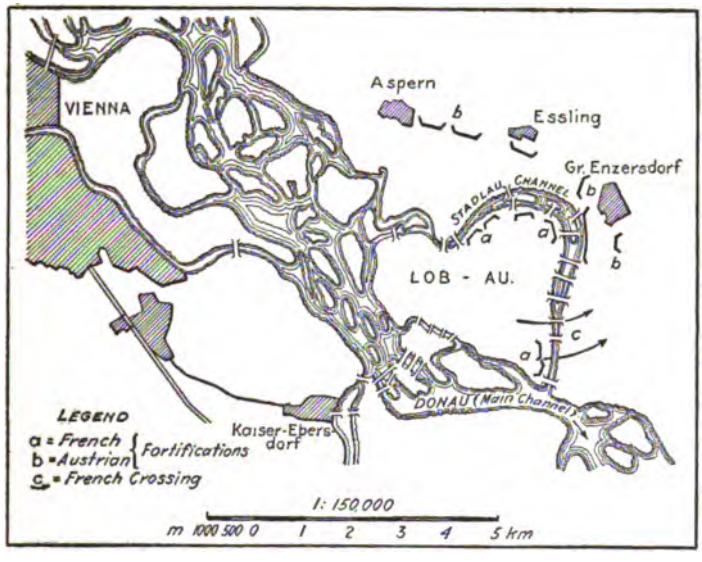

Fig. 11.

Crossing of the Danube before the Battle of Wagram.

to deceive the enemy. But good artillery positions are a condition precedent to the execution of such a crossing. If they are lacking, or if the enemy can oppose them from others equally good, then nothing remains but to make use of the procedure employed at Dietikon, viz., to surprise the hostile force guarding the river line by ferrying troops across, and to build a bridge under their protection. It goes without saying that the attacker, if his design is discovered prematurely, must, in this case like-

When the terrain permits preparations to be made during the daytime, the whole operation is, of course, greatly facilitated. To dispense with artillery fire during the day, when it can be aimed and observed, is a questionable proceeding. If troops are successfully thrown across as at Wagram, where the river is comparatively narrow, early counter-attacks by the enemy need not be feared, to be sure, as he would thereby have to run all the risks incident to a night attack.

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wise, use force vigorously. His artillery, in particular, should play a decisive rôle by directing its fire upon hostile reinforcements, but the secrecy of the undertaking should be maintained as long as possible. The opening of fire, particularly by artillery, should therefore be postponed as long as possible. Though he

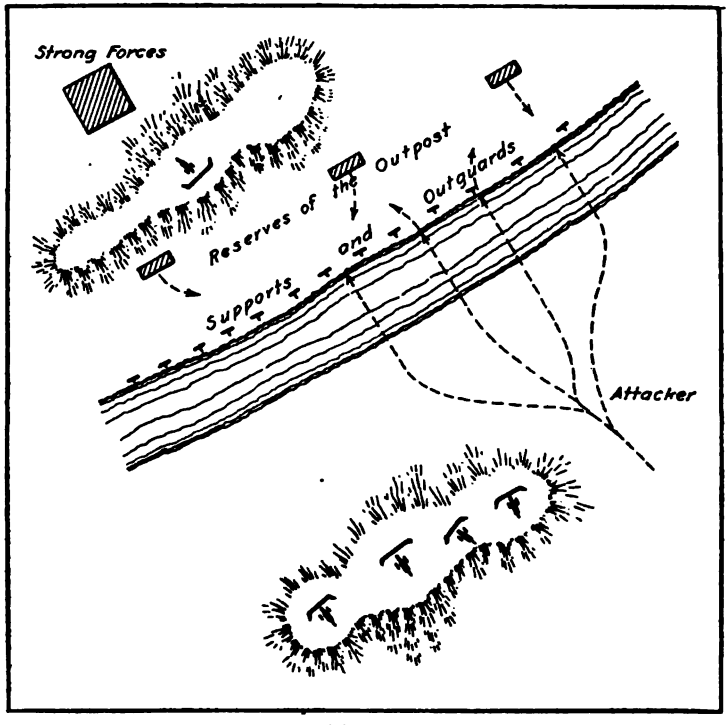

Fig. 12.
Overpowering a Force Closely Guarding a River Line.

may have no other information whatever, the thunder of the guns may cause the commander of the main hostile force to march to the threatened point.[1] And this is the very last thing

[1] In August, 1799, Archduke Charles intended to advance with 48,000 men over the Aar. Complete secrecy was maintained, but 38 heavy Austrian guns, although posted in a commanding position, did not succeed in clearing the hostile bank of the small French covering force of only two companies. For some unaccountable reason troops had not been thrown across to cover the operation. Two ponton bridges were to be built simultaneously and the pontons were not used for ferrying troops across because it was feared that

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that the attacker would want to happen. His covering troops appear only little by little on the hostile bank, according to the ferrying facilities, and the later strong hostile forces advance against them the better. While it may be necessary to open a vigorous fire at the crossing point in order to break down the resistance of the hostile river guard while the troops are being ferried across, it is not really desirable to do so until definite indications point to the conclusion that the whole undertaking has been discovered and that the hostile main forces are approaching. Discovery by the hostile river guard of the attempt to cross by no means indicates that the hostile commander-in-chief has been informed thereof. In spite of telephone, cyclist, and mounted messenger service, it has frequently taken hours during maneuvers, for such information to reach a commander who was but a few miles away.

If, therefore, the situation requires that a crossing be made in face of hostile troops, the last described procedure will usually be the proper one, unless conditions are especially favorable for the attacker's artillery. In order that the details of this most difficult of all river crossings may be understood, its general course will now be investigated and discussed more thoroughly. Conclusions applicable to more simple situations may easily be drawn therefrom. Whether or not the amount of available service equipage permits large units to cross the river simultaneously at a number of points, the various columns mutually supporting each other, thereby increasing the probability of bringing the undertaking to a successful issue, is by no means of vital importance. Each of these crossings is governed by the same principles that are laid down in the following pages as applicable to a single case.

DEFENSE OF RIVER LINES.

The defense will be taken up first.

If we eliminate the indirect defense of a river line, i. e., one in which strong forces resting upon fortresses or *tête du ponts* prevent the enemy, by offensive action on his own bank, from

that would retard the progress of the work. The technically difficult construction work (poor holding ground) did not make adequate progress and the whole operation finally failed when Generals Ney and Heudelet marched to the sound of the cannon and prepared to oppose the Austrians in case they attempted a crossing.

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crossing, the defender can choose one of two methods for warding off the opponent.

I. He can endeavor to prevent formed hostile bodies from making any lodgment whatever on his own bank, i. e., frustrate the attempted crossing, if practicable, while it is in progress. (See Fig. 13.) With this end in view, he occupies his side of the river, or at least the most important points thereof, with a dense cordon of sentinels and outguards, posted immediately on the bank. Outpost reserves are posted in rear of this first line,

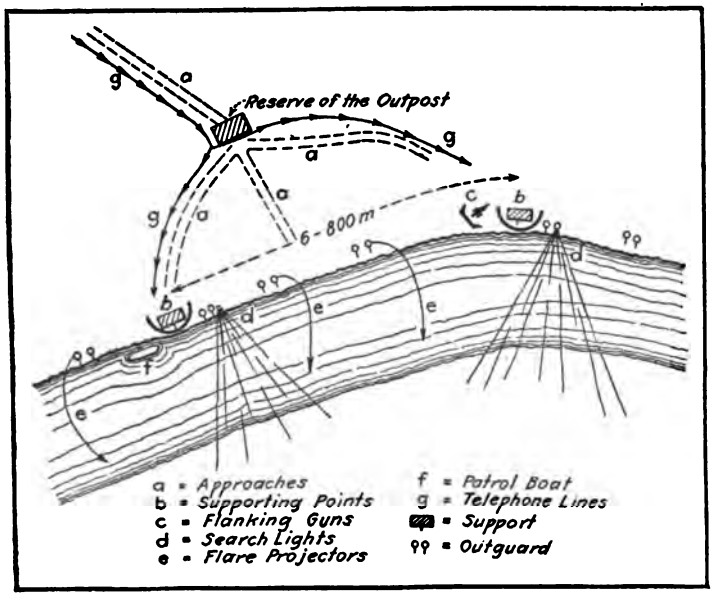

Fig. 13.

Example of a Closely Guarded River Line.

in readiness to reinforce any part of it quickly. Strong retained forces are brought up so as to be on hand to support the outpost in case of need.

II. The defender merely occupies and observes the river with a small force, but concentrates strong forces in rear, at loca'ities having good communications, with the intention of advancing promptly against the points at which the attacker has broken the thin line of observation and has landed strong forces.

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In either case, particularly in the first, the attacker will be in a tactically unfavorable situation. But the defender will rarely be able to bar a long stretch of river line in so thorough and reliable a manner without unduly dispersing his forces. In addition—and this applies particularly to a retreat, he will rarely have the time to provide and to organize such a dense cordon. Military history shows that rivers were usually guarded with inadequate forces and this explains why crossings were generally successful provided the preparations therefor were thorough. But it would be a grave error, indeed, to conclude from this that the difficulties of a crossing in the situation in question can be underestimated with impunity.

But whether the defender is guarding the river bank closely or whether he has merely posted small observation groups there, he will always endeavor to get all the information he can, by means of aircraft and patrols, of the situation on the hostile side of the river. His scouts, secreted in villages and forests passed by the attacker, will send in prompt intelligence of the direction of advance and strength of the hostile force. All his patrols and scouts will be supported either by the garrisons of strongly fortified bridge heads or supporting points that he has left for the time being on the hostile bank, or he will establish concealed message collecting stations from which all messages are transmitted across the river. (See Fig. 14.)

In case the defender is closely guarding the river itself, all outguards and supports should intrench directly on its bank. They should be supported by guns and machine guns posted so as to sweep the river with their fire. They should be ready at any time to throw patrols across the river to push the reconnaissance in case it should be checked. Batteries should be intrenched in commanding positions in rear of the supports, all points permitting a good view should be utilized as observation stations, and the reconnaissance should be supplemented by captive balloons. Good approaches should be provided between the various units on the river bank and the supporting troops in rear. But, above all else, an extensive telephone system must be provided to connect all headquarters, batteries, and observation stations, in order that assistance can be quickly called for and despatched to threatened points. If we include, in addition, expedients of all kinds for furnishing illumination,

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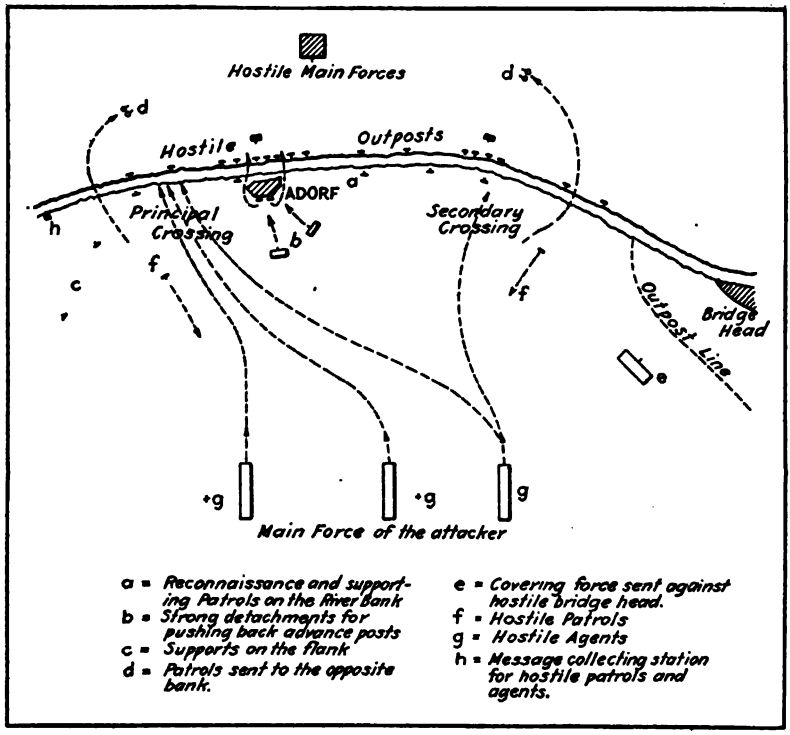

Fig. 14.

Scheme of Advance Preparatory to Making a Surprise Crossing.

and power boats for transportation and guard purposes, all the principal aids of the defender will have been enumerated.

Let us now turn to the attacker.

CONDUCT OF THE ATTACKER.

The columns of the attacker, plentifully supplied with pioneers and bridge trains, will ordinarily approach the river on a broad front, so as not to draw the defender's attention from the very start to a definitely threatened locality. This advance can not be concealed from hostile aircraft. Therefore, the defender can pretty definitely count on a crossing being attempted, if the whole situation at all invites it.

Meantime, the attacker will have despatched his aeroplanes and airships across the stream from a distance and will have

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pushed his reconnaissance detachments up to and, if practicable, also across the river. These detachments are primarily charged with tactical reconnaissance. From the manner in which the enemy is holding the river line and from the position of his main forces conclusions may be drawn as to his intentions, i. e., whether he desires merely to gain time or to offer an obstinate resistance. The tactical and technical measures to be taken by the attacker will, likewise, be influenced materially by this reconnaissance. In case conditions are unfavorable for making observations from aircraft, it will, indeed, be anything but easy to continue the tactical reconnaissance beyond the obstacle. The uncertainty of field warfare, will no doubt, make itself doubly felt at the barrier of a water-course, and will necessitate making decisions even without accurate information of the enemy.

The reconnaissance detachments are followed by stronger forces, which are primarily charged with the duty of driving across the river all hostile patrols and other detachments. Strong cavalry units, at the same time, after rendering harmless any remaining hostile advance cavalry, endeavor to cross the stream with their own equipage, outside the hostile effective zone, and to advance from a flank against the enemy. In case fortified bridge heads are located within the zone of the advance, strong detachments must be sent against them, so as completely to preclude any action on their part in the locality where the crossing is to be effected. It may sometimes also be necessary to detail strong detachments to guard against hostile attempts to cross the stream. The attacker will then have to assume the rôle of defender on the threatened stretch of river.

In the preparations for a crossing, the tactical reconnaissances, which predominate, are supplemented by those of a tactical-technical character. In the first place, the site of the bridge must be determined upon, and, simultaneously therewith, points must be reconnoitered at which troops may be thrown across the stream for the purpose of covering the construction work. It may likewise be desirable perhaps to divert the enemy's attention from the actual crossing point by means of feints or by secondary operations of various kinds.

The crossing itself consists of two operations—a tactical one,

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comprising the ferrying of covering troops across and their combat with the hostile forces on the opposite bank, and a technical one, comprising the actual construction of the bridge under the protection of the covering troops. The troops that are to be thrown across should be organized by the commander into provisional tactical units and provided with the requisite number of pioneers and bridge equipage, other pioneer units being held in readiness for bridge work.

The troops detailed to cover the crossing advance to the river in as many columns as there are crossing points, waiting, if practicable, until nightfall before doing so. At some point far

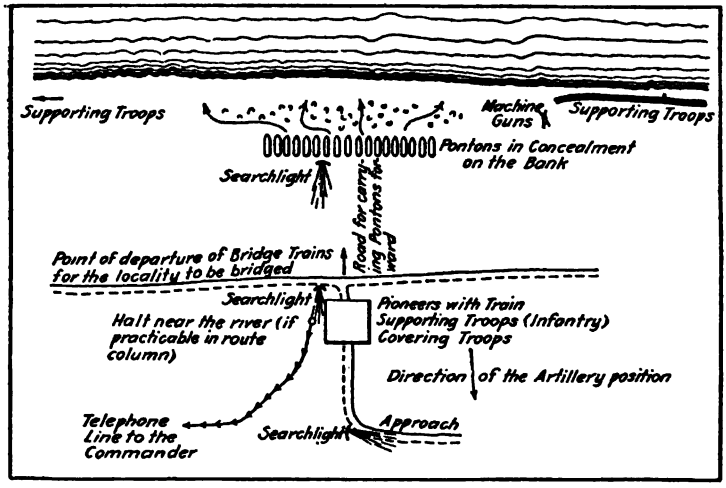

Fig. 15.
Preparations of the Attacker on the River Bank.

enough from the river to prevent hostile searchlights and the rattling of wagons, neighing of horses, etc., from betraying its presence, each column should halt. (Fig. 15.) Here the commander receives the final results of the reconnaissance and makes the final dispositions of his troops. Whether the bridge trains can approach closer to the river without being observed, or whether the pontons will have to be unloaded at this halt and carried forward, will depend upon the width of the river, the character of the terrain, the vegetation on its banks, and the weather. At this halt, it will likewise be decided whether the

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pontons can be launched at once—and this would be exceptional, or whether they will have to be placed in readiness in the nearest available cover from which they are then carried forward and launched only when the ferrying of troops is to begin. In making all these preparations, it should constantly be borne in mind that the enemy's attention must under no circumstances be drawn to the undertaking by noise of any kind.

The supporting troops—infantry and machine guns (usually detailed from the covering troops) and artillery, should promptly go into their assigned positions on the near bank, from which they can, if necessary, support the operation with their fire.

When the hour designated for the crossing arrives, the pontons, which are either already in the stream or are quickly carried to the river and launched, are manned and, as quietly as possible and simultaneously, rowed to the opposite bank. The first echelon is as rapidly as possible followed by a second. In general, the ferrying is continued until the bridge, whose construction has meanwhile begun, is completed. The covering troops thrown across should push back the hostile troops occupying the river bank and protect the bridge work against a hostile attack, which is to be anticipated if the enemy has discovered the crossing point.

The bulk of the troops, which are destined to cross the completed bridge, need not be placed in readiness before the bridge is completed. But orders for this should be issued in plenty of time so that troops may be promptly available if, contrary to the original intention of the commander, more have to be thrown across before completion of the bridge, or if a broader deployment of supporting troops on the near bank becomes necessary than appeared to suffice at the outset.

This is a rough sketch of a surprise river crossing, such as occurred at Dietikon, and as is laid down in our regulations. Let us now go into a few details.

PIONEERS AND BRIDGE TRAINS WITH TROOPS.

Pioneers Needed.

The great demand for pioneers that appears in all river crossings has already been pointed out. The increased demands that will have to be made upon the pioneers in surprise crossings will be discussed below.

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According to maneuver experience, such a crossing over a river 200 m. wide, for which the bridge trains of two army corps have to be combined, will require approximately the following pioneer personnel:

For ferrying covering troops across at four points.....	4 pioneer companies
For preparatory bridge work on the near bank and for bridge work itself.....	2 pioneer companies
For preparatory bridge work on the opposite bank and for bridge work itself.....	½ pioneer company
For one secondary crossing operation.....	½ pioneer company
For other work (for example, for constructing approaches and as a reserve).....	1 pioneer company
	8 pioneer companies

If the two army corps have six pioneer companies available, two others will have to be taken from other units and assigned, in order that the river that is to be crossed in face of the enemy, may be bridged with some degree of certainty and celerity.

The example is cited in order to show what an extraordinary number of pioneers is needed for such operations. Military history furnishes similar proof. During the crossing of the Limmat, which is about 90 m. wide, four and one half pioneer companies and, in addition, civilian boatmen were used; at Alsen, each division required four and one half pioneer companies and at the Yalu three pioneer companies. According to an estimate[1] based upon service tests, eleven pioneer companies and the bridge trains of four army corps would be required for a surprise crossing of the Rhine (350 m. wide) at Mannheim.

The weakness of our pioneer organization will simply make it impossible to make all the needed personnel available. We shall have to get along as best we can with fewer men. But superior commanders should clearly understand that the prospect of quick and reliable execution of the undertaking is diminished thereby, and that much more is left to fortuitous chance, which may tend to compensate for one's weakness, than should be the case in such important operations as crossings in the face of the enemy are often likely to be. The shortage in pioneers can not be made good by assigning infantry. But it is absolutely necessary to assign infantrymen, over and above the requisite pioneer personnel, to accompany bridge trains, to serve as supernumerary oarsmen, as carriers, and to construct approaches.

[1] "Mitteilungen des Ingenieur Komitees," 42, p. 36.

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Service Bridge Equipage Needed.

The amount of bridge equipage required has already been discussed, and it is only necessary here to go in detail into the amount needed in surprise crossings.

During maneuvers we usually have to manage with inadequate bridge equipage. As a rule, the available pontons merely suffice to span a river, leaving very little equipage to spare. In consequence, means for ferrying troops across a stream are lacking, a condition that should never exist in war. Up to the very moment that the stream is spanned, means must be available for continually ferrying troops to the opposite bank, so that, if the troops already across are hard pressed, they may be effectively supported. It would, therefore, appear that about twice as many pontons as are needed for a simple bridge should be on hand. At Dietikon, 16 river boats were assigned for no other purpose than that of ferrying troops across.

Attention has already been called to the importance of having the bridge train near the head of the column when a river course is approached. If practicable, it should be concealed during the day preceding the crossing near the place where it is to be used, but not so close that the enemy, if he discovers its position, can draw definite conclusions as to the point of its subsequent employment.

To make up for the lack of service bridge equipage by using improvised material is a very questionable proceeding. The whole bridging operation, which is predicated on the use of our excellent service equipage and which proceeds simply and quickly provided appropriate preparations have been made, at one stroke becomes extraordinarily complicated. The requisitioning of boats—the first requirement, consumes a good deal of time in itself, and loading them on wagons and carrying them forward by men is coupled with considerable difficulties.[1]

Improvised material that the enemy has not carried off and that is accidentally found on hand in the locality is, of course, utilized—for example, by assembling river boats at some point, in so far as the crossing point is not betrayed thereby. It is used to special advantage (by preference) at points where feints or secondary crossings are planned. Aside from this, a need

[1] At Dietikon it took 100 men to carry some of the boats to the river bank.

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for improvised material does not exist until the service ponton bridge is to be replaced by one of an improvised character or until other bridges are to be built beside it.

In case the service equipage suffices at a pinch for constructing several bridges over a narrow stream, it should be distributed in such a way that the most important bridge can, at all events, be built entirely with it. If an equal distribution is made of the service equipage, construction work is usually retarded at all points, as improvised material will have to be used everywhere.

PROTECTION AGAINST HOSTILE RECONNAISSANCE. (See Fig. 14.)

Effective hostile reconnaissance precludes any possibility of surprise. The attacker must, therefore, leave no stone unturned to prevent such reconnaissance. To this end, all posts that the enemy has pushed across the stream, must, in the first place, be simultaneously forced back to the other bank, but it is just as important permanently to prevent him from again throwing patrols across. This is best accomplished by posting small cavalry or infantry detachments on the near bank, unless the extent of the stretch of river to be watched makes such measures impracticable.[1] But the attacker need not occupy his bank with as dense a line as the defender, provided active patrolling along the river is kept up. It is sufficient if posts and patrols prevent any attempt on the part of the enemy to throw scouts across, to patrol the river with power boats, or to keep up navigation of any kind whatever on the threatened stretch of river. It should be remembered in this connection that hostile soldiers may attempt to cross by swimming.—The posts remain in their positions during the progress of the entire crossing operation, and, at the same time, support, as far as they are able, the reconnaissance and all preliminary work of the pioneers at the ferrying points and at the bridge site.

The detachments pushed forward for security should, in the first place, carefully refrain from attracting the enemy's attention. If they are not cautious in their conduct, the defender's attention may be drawn to the very points at which the crossing

[1] The Russo-Rumanian guard along the north bank of the Danube was so efficiently managed at the opening of the Russo-Turkish war (1877–78), that all Turkish reconnaissance across the stream was practically precluded. The Danish reconnaissance across the Schlei was just as effectively prevented by a few escadrons during the early part of February, 1864.

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is to be effected. They should, likewise, be sufficiently well informed in regard to the undertaking planned, to prevent their firing upon friendly boats or patrols.

If it is impracticable to watch the river in this manner, the cavalry should at least be directed to prevent hostile patrols that have crossed the river, from getting information of the measures taken by the attacker, and to interrupt their lines of information. If operating in hostile country, special watch should be kept over all suspicious civilians, which, in this age of motor cars, bicycles, telegraph and telephone lines, might attempt in a round about way to smuggle information detrimental to the attacker to their own side.

The flanks of the whole area in which the crossing is to be effected require some protection likewise (see Fig. 14 at *c*), detachments being posted on the principal roads leading toward the flanks, so as to prevent hostile reconnaissance.

But the best protection against hostile reconnaissance consists of keeping time and place of the intended crossing secret as long as possible and to effect the requisite distribution of troops, if practicable, during the night preceding the crossing. If this is done, even hostile scouts that hang on the flanks of the columns will not be able to bring back information in time to be of service.

Strong columns of troops marching by day to the crossing points may be discovered and reported by suddenly appearing hostile aeroplanes.

Villages located near the river bank should be avoided if practicable during a night advance. Dogs in them should, if requisite, be disposed of, but this may be reported to the enemy and may attract his attention to the selected crossing point. The best way to prevent treacherous villagers from reporting or signalling information to the enemy of the advance to and preparations at the crossing point will, no doubt, be to occupy the village and to surround the troops with a dense cordon of outguards and patrols that arrest anyone who attempts to pass.

RECONNAISSANCES.

Attention has already been called to purely tactical reconnaissances to and across the river. These are to furnish the commander as much information as possible in regard to strength

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and dispositions of the enemy, this serving as the basis for determining in what manner the crossing may be effected. In the following pages, it is proposed to discuss in detail tactical-technical reconnaissances only, which are necessary at the river and beyond it for proper preparation of the crossing. Their great importance need not be emphasized here, since not only the experience gained during peace exercises but that of war itself amply demonstrates it.

In order that the character and object of these reconnaissances may be more readily appreciated, an example known in all its details was selected from a peace exercise to serve as an illustration. The example selected consists of the crossing of the Rhine during an extensive pioneer exercise conducted in the Second Pioneer Inspection District in 1905. (See Map 1.)[1]

Example.

A Blue force, after being defeated in the west, retired over the middle Rhine. While a strong Red army was to cross in pursuit north of the fortress Mayence, which was invested on the west bank, the Red Ist Army Corps was to cross south of it. The bulk of the Red forces was advancing on Alzey and Biebelnheim. Opposition, on the right bank of the Rhine, by the feeble general reserve of the fortress Mayence was not precluded. Nothing but Landsturm troops were to be stationed south of the fortress and it was expected that they had made adequate and suitable arrangements for guarding the line of the Rhine clear to the fortresses of Germersheim and Strassburg. All bridges over the Rhine that were not protected by fortresses had been destroyed.

The Reds will unquestionably have to initiate their operations by means of reconnaissances.[2] These consume considerable time in so difficult an operation as that of crossing a stream 300 to 400 m. wide. The preliminary reconnaissance to determine "where" the crossing is to be effected will, no doubt, occupy a whole day. If this work is done thoroughly, the crossing may be made in immediate continuation of the advance in case the passage is to be effected at a distance from the hostile main

[1] See "Mitteilungen des Ingenieur Komitees," 42.

[2] In this and subsequent discussions based on the crossing south of Mayence, the terrain extending to Worms, exclusive, is considered.

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forces, or by force. If, on the other hand, one is compelled to make an attack against a strongly occupied bank, two whole days may pass before detailed reconnaissances are completed to determine "how" the crossing is to be effected and before dispositions and other preparations are completed with the requisite thoroughness to preclude, as far as possible, any undesirable interruption.

Study of Maps

Tactical considerations are of such decisive importance in determining "where" the crossing is to be effected that the commander will usually be able to indicate directly from available topographical data or from the map, the stretches of river where bridges would be desirable. The senior pioneer officer will, no doubt, be called upon to give his opinion in the premises and—likewise basing his views on a study of the map, can bring up the technical points that, even in these initial decisions of the commander, must exert a potent influence. But tactical considerations are, for the time being, paramount, and technical desiderata do not exert a deciding influence until it becomes necessary to compare the results of local reconnaissances in order to select the most suitable crossing point from among a number of practicable ones.

The whole situation in the example under discussion invites the Red commander to continue the pursuit without making any appreciable detour. This focuses his attention upon a crossing immediately south of the effective zone of the fortress Mayence, say upon the region between Oppenheim and Gernsheim. To throw a bridge across the Rhine in closer proximity to the fortress would be inadmissible in view of the range of the fortress guns, which might be posted on Laubenheim heights. Strongly fortified and garrisoned positions whose location is known, may exert a similar influence as Mayence does in this case.

The Red commander may anticipate that the river will be closely guarded in this region and that the hostile covering force, recognizing its importance, will be prepared to make a stubborn resistance. He may, perhaps, be led to believe by his airmen that the main hostile forces are located say at Darmstadt, Griesheim, and Pfungstadt (where they actually were). In

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either case, a crossing in face of strong hostile forces might be avoided by selecting Rhein-Dürkheim as the crossing point. The latter is about a day's march from the main hostile forces. A bridge, for whose construction we must allow approximately six hours, could be completed at this point before strong hostile interference would become effective.

If, in view of the situation, it appears undesirable to evade a collision as suggested above, in other words, when a fight at the crossing is unavoidable, tactical considerations become paramount. Artillery coöperation is of decisive importance. This naturally directs attention to any commanding river bluffs which give the attacker's superior artillery an opportunity to go into position under cover and to bring long range enveloping and dominating fire to bear on the opposite bank, if practicable, completely sweeping it. On the other hand, any terrain on which good, commanding artillery positions are located on the defender's side of the river, while the flat, broad river bottom opposite offers no positions at all to the attacker's artillery, should be carefully avoided. In the Mayence exercise, the artillery positions west of Oppenheim—as may be readily seen on the map, were absolutely ideal. They commanded the surrounding country so effectively that, as the Blues themselves were unable to find suitable artillery positions, even a possible advance by strong forces against the Red covering troops thrown across, was bound to be doomed to failure. In this case, by the way, all the conditions were fulfilled that make it unnecessary to ferry troops across at night, and that permit a crossing to be forced in the daytime by means of the artillery. At all other points of the stretch of Rhine in question, the nature of the terrain precludes any tactical coöperation on the part of the Red artillery in effecting the crossing. Other weighty reasons would, therefore, have been necessary to induce the Red commander to make the crossing at a point other than at Oppenheim.

If the Red commander was not influenced, as above indicated, by the desire to avoid any collision with strong hostile forces (which would have prompted the selection of Rhein-Dürkheim), he might have been influenced by considering what hostile positions he would be forced to attack after crossing, if the bulk of the defender's forces were to act on the defensive, for the time being, on the defender's side of the river.

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In crossing a river and in constructing a bridge in rear, great difficulties are not likely to be encountered. But in the subsequent advance, hemmed in by the river itself or by impassable terrain, one may encounter the enemy in a strong position that can only be taken by frontal attack, and, at the same time, come under the fire of his admirably posted batteries without being able to reply to their fire with artillery in correspondingly good positions. The advantages of an easy crossing would then be lost and it is, therefore, undesirable to attempt a crossing opposite such positions. Such conditions are especially apt to arise in bends the concave side of which is turned toward the enemy.

The terrain selected in our example does not fit this case exactly. The river bottom southeast of Oppenheim will give an approximate idea. If for any reason the principal crossing was made at the big bend opposite the Knoblauchsaue, the crossing itself would, perhaps, not be difficult. But should the bulk of the enemy's force occupy the position Rhine—Kammerhof—Bensheimer Hof—Rhine, with a good, strongly held artillery position in rear (which was not the case in the example), the Reds, hemmed in by the Rhine on both flanks in their advance, might encounter considerable difficulties in crossing the meadows in the river bottom. These difficulties could be removed only if commanding artillery positions enfilading the hostile line were located say east of Oppenheim and southwest of Erfelden on the left bank of the Rhine.[1]

But unusually good hostile positions on the opposite bank are not the only factors that militate against some particular crossing point. Any terrain that might offer special difficulties to the advance of our troops after they have effected a crossing, such as marshes, swampy meadows, river arms, and streams of every

[1] A very similar situation existed during the crossing of the Elbe at Wartenburg by York's Corps on October 3, 1813. The crossing point was located at a bend in the river and was so effectively dominated by the Prussian guns that the French made no attempt to oppose the ferry service or the bridge work. But on the opposite bank, the Prussian troops found themselves on a plain intersected by numerous dry gullies and bayous, which considerably hampered their advance.

The French infantry occupied a strong position, which consisted of a dam that extended directly across the peninsula. After a fight lasting all day, the Prussians finally succeeded in rolling up the French line from the south, and not until this was accomplished could the crossing have been called a successful one. (See Fig. 16.)

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kind, is of advantage to the defender if it creates specially favorable tactical conditions for his supporting troops and thereby gives his reserves time to come up. In this, likewise, one must rely on the map, for in exceptional cases only, will it be practicable to reconnoiter the opposite bank effectively. Reconnaissance of such unfavorable stretches of river is usually dispensed with entirely. In our example, the sections *B*, *C*,

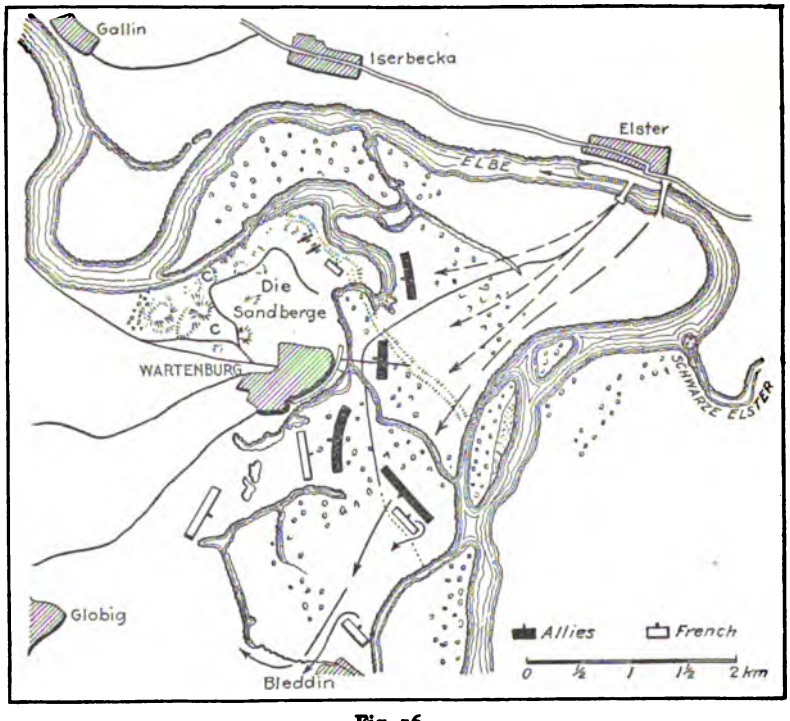

Fig. 16.
Crossing at Wartenburg, Oct. 3, 1813.

and *D*, may be eliminated from reconnaissance, because the terrain on the opposite bank does not invite a crossing. Section A may be added to the above, because it lies under the guns of Mayence.

It would be a grave mistake on principle to avoid terrain that is unfavorable for a crossing, especially if the enemy guards it feebly and the crossing can be effected at a distance from

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strong hostile forces. (Example: Crossing at Caub.) One may actually be forced to seek such terrain and to place in readiness special technical material for crossing and for the subsequent advance, if one is opposed by a wide-awake and strong antagonist who holds all favorable crossing points so strongly that success at any one of them is out of the question.[1]

Finally, one must give due consideration to good road communications with the bridge, as they are of decisive importance for it. Long defiles, narrow causeways over marshes, heavy grades on roads leading to the river, etc., or places where the narrowness of the valley hampers the deployment of the troops and communication between them, and interferes with the technical preparations for the crossing, are objectionable. In selecting a bridge site, one is, moreover, restricted to ferry points, to the vicinity of demolished bridges, at the very least, however, to good roads in immediate proximity to the river. In our example, the principal points to be considered in selecting a bridge site would therefore be, Nackenheim (eliminated on account of its proximity to the fortress), Kornsand, south-east of Nierstein, Gernsheim, Rhein-Dürkheim, and Rhein-Dürkheimer Fahrt. Certainly, not many practicable crossing points for a stretch of river some 35 km. long. All other crossing points would, in all probability, be only makeshifts that would soon necessitate moving the bridge, a proceeding that is, at best, undesirable.

But this does not mean that the choice of a bridge site is governed by good approaches only. The principal thing is quickly to establish solid communication over the river at a reasonably suitable point, so that troops can be led across to the attack. Once the enemy is defeated here, the question of removing the bridge to a more suitable location so as to make it practicable for permanent traffic, can be solved later.

Thus, attentive study of the map gradually narrows the

[1] During Soult's crossing of the Linth in September, 1799, only one place suitable for throwing troops across and for surprising the enemy could be found. To make matters worse, the troops had to cross a marshy meadow 300 m. wide before they could reach the river. To make this passable at a timely moment would have betrayed the whole operation. The French accordingly corduroyed this impassable marsh during the night of the crossing with boards and fascines, completing the work by 4 A.M., a performance that would, no doubt, have been impossible but for thorough technical preparation and the assistance of a considerable force of infantry.

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selection down to a few localities suitable as crossing points. Toward these the reconnaissance should be primarily directed. To reconnoiter the entire river line indiscriminately would not only be absolutely wrong, but a considerable waste of energy. That feint reconnaissances will have to be made elsewhere and will have to be coördinated with the principal ones is a task by itself, and will be described later.

The reconnaissance can, therefore, be made in definitely restricted areas. For this, likewise, a preliminary, more detailed study of the map, is recommended, which will draw attention to roads, islands in the river, bays, variations in the width of the stream, etc. By working out the problem on the map one may be able to avoid a good deal of useless marching and gain a clear idea of the nature of the terrain, which is apt to confuse the eye with its multitude of details.

The Object of Local Reconnaissance.

Within the areas outlined, a suitable bridge site must be selected, ferrying points in connection with the bridge site designated and, finally, places for feints or secondary operations determined.

As the ponton regulations and the Pioneer Field Manual give adequate information, the technical considerations governing the choice of a bridge site will not be discussed in detail. The importance of good road communications has already been emphasized; narrow places in the stream and shallow water near the banks are desirable. One tactical requirement should be particularly noted, viz., the completed bridge must be safe from hostile artillery fire, or, at the very least, as far as possible safe from hostile artillery observation.

The number of ferry points depends primarily upon the resistance that is anticipated on the opposite bank. If one expects to encounter nothing but a small hostile covering force, or can count upon the effective support of one's artillery, it is generally sufficient to throw troops across at one point only. (Caub and Beresina.) It is highly desirable, however, to cross on as broad a front as possible. The more difficult the tactical conditions appear to be on the opposite bank, the greater the number of points at which troops should be thrown across for mutual coöperation and support. The width of the stream, the

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amount of ferry equipment and the number of pioneers available, roads, harbors, bays, lack of elbow room at embarkation and disembarkation points, etc., may exercise an influence in determining the number of points at which troops are to be ferried across.

The ferry points must be an adequate distance apart, concealed from hostile observation, and, above all else, sheltered as much as possible from hostile artillery fire. As a matter of course, they should lie in the vicinity of the bridge site that is to be protected. The position of the enemy and local conditions may, however, make it desirable sometimes to separate ferry points farther from the bridge site. But this presupposes a plentiful supply of bridge equipage, and troops must, in any event, be thrown across the river in immediate proximity to the bridge for the latter's local protection.

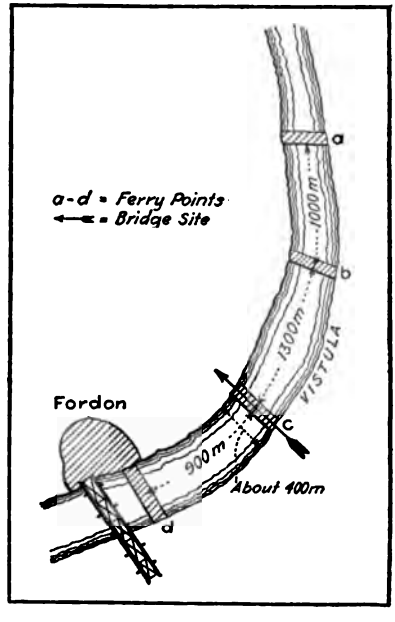

Fig. 17.

To ferry troops across at the bridge site itself, is an expedient little to be desired, as this is very apt to hamper construction work on the bridge. When the current is swift, it is likewise undesirable to cross too close above the bridge, as pontons that break loose may damage it.

Fig. 17 shows the ferry points and bridge site selected for a crossing of the Vistula during a maneuver. Ferry *c* was moved to a point below the bridge after carrying the first load across. The general dispositions here used would have been disadvantageous if the current had been more swift, as it would have been difficult to get pontons employed below the bridge back to it.

The width of the river at a ferry point is not of decisive importance. The defender is not apt to consider wide reaches of river as threatened. Consequently, the operation of ferrying

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troops across, in spite of the longer distance to be traversed, may stand a better chance of succeeding than at a narrower and, therefore, better guarded point. It should, however, always be remembered that it is especially valuable to be able to support the crossing from a good artillery position. It is very risky to select ferry points in the vicinity of localities that, by their very nature, invite hostile occupation, such as farm buildings, villages, towns, whose garrisons are by no means easy to dislodge by fire delivered from the near bank.[1]

Ferries are not dependent upon roads leading to the river. On the contrary, they are preferably located where communications appear to be unfavorable, as one can count with some degree of certainty on the hostile bank being but inadequately guarded at such points. But good roads to the point where the pontons are to be unloaded are all the more important. It is, therefore, desirable to have the commanders of the bridge trains assist in the reconnaissance if practicable. Insufficient reconnaissance and carelessness in selecting roads for the bridge trains have produced the gravest consequences both in peace and in actual service and have delayed the whole operation for hours.

As the roads are to be used at night, they need not afford any special concealment. But this is not true of the terrain on the river bank itself. Here darkness will not suffice for concealment, as searchlights and flares may betray movements that are not screened. Actual and physical concealment in the vicinity of the river bank is, therefore, absolutely essential. It is to be remembered that villages and road defiles near the river are favorite targets of the artillery. One should, as a rule, endeavor to avoid using them for the advance and as assembly places and try to locate practicable routes for turning them.

It is an advantage if the nature of the bank permits the noiseless launching and manning of the pontons. Harbors, bays, river arms, or the cover of islands, offer the best facilities for

[1] The plan for the crossing of the Schlei in 1864, did not contemplate that troops were to be ferried across at the start at the bridge site opposite the town of Arnis. The ferry points were located a quarter of a mile north and the same distance south of the proposed bridge site, opposite which a strong hostile force was anticipated. A crossing was to be effected here only after the concentric advance of the troops thrown across on the flanks forced the hostile evacuation of the city.

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the quiet embarkation of the covering troops, but the defender will usually be especially alert opposite such favorable embarkation points.

The terrain on the opposite bank should be such as not to impede the movement of the troops thrown across. But in certain circumstances, as already mentioned, barely passable terrain, which for that reason is either guarded poorly or not guarded at all, may be particularly desirable as a landing point. If such is the case, provision must be made for quickly surmounting any obstacles encountered, by supplying the covering troops with improvised material (for example with hasty bridges).

Feints and secondary operations are to divert the enemy's main forces from the principal crossing point. They are, therefore, generally staged at a distance from it, and at a point where the enemy might reasonably expect the principal crossing to be made, in view of the general tactical situation. In our example, in the Mayence theater of operations, as the principal crossing was to be effected at Rhein-Dürkheim, a feint or secondary operation at Oppenheim would have been eminently proper. As a matter of fact, the Blue commander actually expected a crossing at Oppenheim and even the secondary crossing executed at Gernsheim failed to shake him in this belief.

Scope of the Reconnaissance.

A clear distinction was drawn above between a reconnaissance made to determine "where," and one made to ascertain in detail "how" a crossing is to be effected at the place finally selected. It is desirable to make this distinction in order that the tasks assigned to a patrol may be sharply divided and that time may not be wasted over unnecessary details during the first reconnaissance in case the place reconnoitered is not selected later on. As a matter of fact, the two reconnaissances overlap. A reconnaissance as to "where" the crossing is to be effected, will simultaneously answer many of the questions as to "how" it is to be accomplished. But these preliminary detail reconnaissances do not suffice; a further, more thorough reconnaissance of the *locality selected for the crossing* must be made.

In order that a general idea may be gained of the whole reconnaissance, and that its intricate difficulties may be properly

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appreciated, an attempt will be made to enumerate its principal problems.

A. Where Should the Crossing be Made?

1. Where should the bridge be located? Is it protected from hostile fire? What are the technical advantages and disadvantages of the place, the character of the approaches on this and the opposite bank (as far as this can be ascertained from the near bank or by men swimming across)? What is the approximate width of the stream? How long will it take, in all probability, to build the bridge, in case the enemy does not oppose its construction?

2. Where should troops be ferried across? Can the supporting troops (infantry and machine guns) bring effective fire to bear on the hostile bank? What are the technical advantages and disadvantages of the several places; in particular, is there any chance to embark troops under cover in harbors, bays, etc.? Are there any roads available for the bridge trains? Any cover for these on the near bank? How should the trains be distributed among the different ferry points? How many men can be transported across at one time? How long will it take to transport each echelon across? In case the current is swift, will it be necessary gradually to shift embarkation points downstream?

3. Are there any good artillery positions on the near bank? If so, where? What should be the mission of the artillery?

4. What is the enemy's situation as regards defense on the opposite bank? What is visible of hostile forts and intrenchments? How should the infantry conduct itself after crossing?

5. Approximately how many pioneers and personnel to assist them will be required at the point to be bridged and at each of the several ferry points?

B. How Should the Crossing be Effected at the Point Selected?

1. *The Following should be Determined for each Ferry Point:*

(*a*) *In General* (see Fig. 15).—1. To what point can the organization with its train advance without betraying itself by noise or by being illuminated by hostile searchlights? What roads lead to this point? How should these roads be indicated at night? Should the trains be escorted during this advance?

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2. Where should supporting infantry be posted? What roads lead to this position? Where should machine guns be posted? May the infantry occupy its fire position early or should it wait until troops embark in the pontons? Is it necessary to take measures against a hostile flank attack?

3. Where and by what roads should the artillery go into position? Is any preparatory work necessary in this position?

4. What lines of information for transmitting orders and messages should be established between ferry points, bridge site, covering troops on the opposite bank, and the commander?

5. Are any special measures, such as covering parts of the roads with straw, killing of dogs, etc., necessary?

(*b*) *For the Pioneers.*—1. Where should the pontons be unloaded? How far must they be carried forward? How should roads be indicated?

2. Should the pontons be laid down under cover on the river bank or can they be launched directly? If so, in either case, where?

3. Do special conditions such as steep banks or shallow water exist at the river that would make launching of the pontons difficult? If so, what remedies must be applied?

4. What is the character of the river, the conditions on both banks? Are there any shallow places? What is the velocity of its current? Its approximate width? Is the ferry point suitable for swimming horses across?

5. How should ponton crews conduct themselves in ferrying troops across? In case of swift currents, are special towing detachments necessary on both banks?

6. What measures should be taken for building ferries?

7. Will it be necessary to attach pioneers with improvised material (for example, with hasty bridges) to the first detachment of covering troops ferried across, for the purpose of removing obstacles on the opposite bank?

8. Exactly how many pioneers and assistants will be needed for bringing up the pontons and for ferrying troops across in them?

II. The Following Should be Determined for the Bridge Site:

1. What is the character of the river, especially the height of its banks, width, depth, and bottom on the near bank, velocity

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of current, and recognizable deep places? Is a special method of construction necessary? Exactly what bridge equipage will be needed? (For the time being it will be impossible accurately to reconnoiter the hostile bank except perhaps by men swimming across).

2. How should communication be kept up with the bridge trains before construction work begins? What routes should trains follow in proceeding from ferry points to the site of the bridge? How should these routes be marked? Where should bridge equipage be parked?

3. Exactly how many pioneers and helpers will be required? Is anything special to be remembered in distributing the pioneers for bridge construction work? What preparations are necessary for construction work at night? Will it be necessary to protect the bridge against floating objects?

4. Is any improvised material or, in particular, are any river boats available near the site of the bridge?

5. Will it be necessary to detail special detachments properly to prepare approaches to the bridge on both banks? What tools will they need?

6. Where should lines of information connecting the commander with the bridge site, the artillery and the several ferry points be located?

The Conduct of the Reconnaissance.

It will be seen from the above that the tasks of the reconnaissance are well nigh overwhelming. Officers charged with reconnaissance will need every bit of tactical and technical knowledge of which they are possessed and will have to utilize all the time at their disposal to the very best advantage, in order to do justice to all demands made upon them and to be able to distinguish the essential from the non-essential. Otherwise no definite results will be accomplished. In practice, it has been found a good plan to write down the most important questions before the reconnaissance begins, and then to divide up the work by assigning tasks in rear to special patrols.

Though the reconnaissance work will be primarily performed by pioneer officers, even those of high rank participating, commanders of troops would do well to devote their whole attention to it. It would be well to imitate the example of Napoleon, who,

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disguised as a Polish peasant, personally reconnoitered the Niemen with his chief engineer at Kovno in 1812, preparatory to crossing that stream with his army. At any rate, general staff officers and adjutants of high rank should very extensively participate in the reconnaissance, though it is always well to remember that too many cooks spoil the broth.

It goes without saying that infantry, artillery and supply officers will finally also be utilized for making detail reconnaissances at the river. But every superfluous patrol at the crossing point increases the danger of attracting the enemy's attention. The necessary singleness of purpose of the whole operation, if nothing else, requires that no more be used than are absolutely needed. An experienced general staff officer and a pioneer officer suffice to determine all that is essential at first, provided they are given enough time, and that should be available if the operation is properly initiated. Their labors will, indeed, be materially facilitated if the commander of the troops has moved forward to the vicinity of the river and is readily accessible to receive all reports.

The reconnaissance should be started as early as possible. The pioneer and, above all else, the senior pioneer officer, with a clear idea of his mission in mind and thoroughly oriented on his map, should arrive at the river with the leading cavalry unit. It is, of course, desirable to start the reconnaissance so early that when the troops arrive, definite results will already have been accomplished, so that the execution of the operation can begin without loss of time. The senior pioneer officer must, in the first place, submit to the commander of the troops reliable data on which the latter can base his decision as to "where" the crossing is to be effected. He should likewise be able, without becoming lost in a maze of details, to take the technical measures required to carry out the letter and the spirit of his commander's orders without loss of time. His experience should enable him to give the proper consideration to the frequently decisive tactical requirements and, consequently, to submit to his commander tactfully worded recommendations that will gain that officer's approval from a purely tactical viewpoint likewise.

A distinct reach of river is assigned from the map to each commander of a pioneer company, who is assisted by his mounted officers and their subordinates. They work ahead of the general

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staff officer and the senior pioneer officer in order to make prompt and thorough orientation possible.

And later, after it has been decided "where" the crossing is to be effected, and each pioneer company has been assigned its tasks, their company commanders should promptly return to the river "to conduct the detailed local reconnaissance, to decide all doubtful points, and, with the terrain before them, to think out in detail the tasks assigned them. For the purpose of bringing up the companies, and for the purely routine preparations, it is sufficient to leave behind one or two officers of each company." [1]

In addition to horses, wagons, bicycles, and motor cars, telephone lines play an important rôle in rapid reconnaissance and in the transmission of information.

It is especially important to determine whether the reconnaissance should be made with the utmost possible secrecy, or whether one should come right out into the open, as the enemy knows anyway that a crossing impends. The latter course has the advantage that no time is lost in cautious beating about the bush and that one can see more thoroughly what one wishes to see. If the defender encounters hostile patrols all along his front and these do not hesitate to draw his fire upon themselves, thereby, aside from otherwise profitable information, gaining more or less insight into the hostile dispositions on the opposite bank,[2] this will not necessarily give him any clue as to the point "where" the crossing is to be effected.—This course of reasoning is justified. But it is always better if quiet reigns on the friendly river bank, for that may, perhaps, increase the feeling of security of the enemy and prevent him from pushing strong bodies of troops to the apparently threatened points or to the entire river line in response to repeated reports of hostile activity.

At any rate, it is by no means necessary to make efforts to attract the enemy's attention and to appear at the river with strong patrols, above all else, not at the points that may have to be used for a crossing or at which one is contemplated. The entire operation should be completely concealed whenever a

[1] From the critique of an extensive pioneer exercise.

[2] See also Calsow, "Fluszübergänge im Kriege," in "Kriegstechnische Zeitschrift," 1911, p. 343.

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crossing at a distance from the hostile main forces is contemplated. Nothing should indicate to the hostile commander that the attention of the attacker is directed upon such out of the way points. The attacker's troops should so conduct themselves that the hostile patrols possibly stationed there can report nothing but "No enemy observed."

In general, it is sufficient to send two experienced officers out to each point to be reconnoitered, who gather all the necessary information at the river. Their entire escort remains in rear under cover, furnishes protection against hostile patrols, transmits messages, or reconnoiters the terrain in rear.

It is of the utmost importance to gain information of the character of the opposite bank at all points where bridges are to be built or crossings are to be effected. Sand banks may make the crossing or the bridge work more difficult, river arms or swamps not shown on the map may interfere with the deployment of the covering troops and may jeopardize the success of the whole undertaking. But it is exceedingly difficult to determine all this. To size up the opposite bank from good observation points on the near side of the river, produces doubtful results; it is far better to get the required information from local river men if one is operating in friendly country. To cross in boats is impossible in face of hostile troops holding the opposite bank, and even if this is effected at an unoccupied point, hostile patrols may accidentally discover and report such crossing, thereby directing the hostile commander's attention to the very points at which one is most anxious to hide everything in the way of reconnaissance and preparations.[1] Nothing remains, therefore, but to swim across. Men detailed for this duty should be equipped with life-preservers, etc. This method should be resorted to at bridge sites and crossing points when adequate information of the local conditions on the opposite bank could not be procured in any other way, or where one wishes to get reliable information, without attracting attention, of the number of troops on the hostile bank.

[1] Before the crossing of the Alsen Sound, on April 18, 1864, two infantry officers crossed in a light skiff, ascertained that a Danish work had been abandoned and spiked two of its guns. In spite of its gallantry, this act was not approved by the Prussian commander-in-chief, who justly feared that such enterprises might attract the attention of the Danes to a part of the island to which they had previously given little attention and cause them to believe that it had for that reason been chosen as a crossing point.

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THE ISSUE OF ORDERS.

The result of the reconnaissance determining "where" the crossing should be made, and a plan detailing the best method of execution in the situation and in the locality selected should be submitted to the commander-in-chief. This should be made in the form of a brief written report, supplemented later on preferably by a verbal one. The earlier this verbal report is made—always after thorough reconnaissance, however, the better. While this verbal report is being made, the officers directing the reconnaissance—a staff officer, and a pioneer officer, should submit definite recommendations in regard to the crossing, which then serve as a basis for the order to cross.

Before discussing this order in detail, it is proposed briefly to recapitulate all that may be said on the subject of orders for surprise crossings of magnitude, especially in so far as it relates to the activity of the pioneers. To this end, let us assume that an army corps, acting as part of an army, is to prepare a crossing over a wide stream for itself and its neighboring corps.

Whether the commanding general should take personal charge of the management of the crossing,[1] thereby displacing his division commanders more or less, or whether he should entrust the operation to a division reinforced by additional artillery, reserving to himself the right to interfere when necessary, need not be considered. Depending upon the magnitude of the task, one or the other method may be the proper one. In any event, the superior commander will not be able to keep from interfering with his subordinates in many cases, and from ordering details without which the absolutely essential unity of action could not be assured. That nothing should be ordered too far ahead, is a rule that likewise holds good here. It is usually sufficient to initiate the operation properly, to take the primary measures for continuing the ferry service and for beginning the bridge, and lastly, to post the troops in readiness close at hand and under cover, in order to be able to dispose of them at any time.

[1] After the unsuccessful attempt to cross the Danube at Nuszdorf, before the battle of Aspern (May 13, 1809), Napoleon directed General Masséna to take personal charge of the crossing contemplated at Kaiser-Ebersdorf. But he did not refrain from personally superintending the embarkation of the first troops to be thrown across, and from sending two of his adjutants along to render reports. "Mitteilungen über Gegenstände des Artilleriewesens," 1912, p. 1201.

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It would be a mistake to bother with prescribing details that do not exert the slightest influence upon unity of action. Hence, all detail measures for feints and subsidiary operations had best be left entirely to the leaders charged with their execution. They will, without doubt, carry out their own measures with greater zeal, if they know that they are acting independently, than if they feel themselves bound by orders from higher authority. In most cases, it suffices to give these leaders a general idea of the task they are to perform and of the time when the operation is to begin, and then let them work out their own salvation.

The pioneers should be used without breaking up organizations. They are withdrawn from their divisions and placed temporarily under the immediate orders of the commander of the pioneer battalion, or of the general of pioneers, in case the latter was detached by the army commander and placed in charge of the technical direction of the crossing. When this is done, all pioneer units drawn from neighboring corps are likewise subject to his orders.

This coördination under one command is necessary while reconnaissances and preparations are being made (such, for example, as bringing up the bridge trains and repairing roads). The senior pioneer officer should likewise utilize this period for discussing the technical details of the enterprise with his subordinates, especially with the pioneer officers commanding at the various ferrying points. He should also request the commander of troops to detail sufficient infantry, so that the bringing up of the bridge trains to the stream may be absolutely assured, and that adequate support for the pioneers may be ready in time at the ferry points and at the site of the bridge.

The distribution of troops in the order for the crossing assigns the pioneer units to be used at ferry points to troop units. As soon as the order is issued, these pioneer units join the organizations to which they are assigned. It is not a good plan to have them remain under the orders of the senior pioneer commander, as under his direction they may exert a decisive influence upon measures that should properly be taken by the commander of troops, who must be designated by name for each ferry point. The crossing is a separate and distinct operation at each ferry point, and must be directed and carried out to conclusion by

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one man. The commander on the spot is responsible for both direction and execution of the work. While he should take into consideration whatever technical preparations may have been made before his arrival and should accept the suggestions of the pioneer officer assigned to him, an energetic prosecution of the enterprise can not be relied upon unless the responsibility rests upon him.

For the bridge construction proper—a purely technical task, aside from the tactical one at ferry points, the pioneers should remain under the immediate orders of the pioneer leader entrusted by the corps commander with this task. This leader receives orders from corps headquarters as to when he is to begin constructing the bridge and, at the same time, is given authority to requisition bridge equipage and, in certain circumstances, pioneer troops from ferry points, in the name of the corps commander.

The orders for the crossing can then be made very simple and comparatively brief.

They should contain approximately the following:

Distribution of Troops:

1. Ferry point A[1]
2. Ferry point B
3. Ferry point C
4. Ferry point, etc.
5. Bridge site
6. Artillery
7. Traffic details
8. Feints; secondary operations
9. Troops not otherwise disposed of
10. Trains and columns

} Commander and Troops.

1. Information of the enemy; mission (task).
2. Plan.—Designation of the bridge site and of the ferry points; hour for opening ferry service; line to be reached by covering troops; name of the commander of these troops.
3. When and where must troops be in readiness at each ferry point? In certain circumstances, designation of the roads to be used; detail reconnaissances to be made at once; details of troops to assist the pioneers, etc.
4. When and where must artillery

[1] Detachments that were pushed to the stream ahead of the troops, should be placed under the orders of the troop commanders at ferry points in whose territory they are operating.

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be in readiness? In certain circumstances, directions as to requisite reconnaissances, etc.

5. When and where must the pioneers and bridge trains be in readiness for bridge work?

   (Independent preparations pursuant to a separate order.)

   When and where must details of troops to assist the pioneers and to bring up bridge trains report?

6. When and where should commanders of troops named in paragraphs 3, 4 and 5 report for additional discussion and to receive orders?

7. Feints and secondary operations. Separate orders for commanders. When and where should troops detailed for this service report?

8. Orders for the cavalry (in so far as this has not been covered under 7 or elsewhere). In certain circumstances the cavalry receives separate orders.

9. When and where should troops not otherwise disposed of report?

10. Orders for such additional telephone lines as may be necessary—separate order.

To the above are then added directions for field trains, divisional trains and colums, and a statement indicating where the commander may be found.

Details in regard to the crossing are omitted from the order for the sake of brevity. They are discussed in so far as this appears necessary at the meeting of the commanders scheduled

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pursuant to paragraph six of the order. By the time this meeting takes place, additional information will, doubtless, have accumulated and can be taken up likewise. Other details that should not be put in the order but that should be taken care of at this meeting are directions prohibiting the lighting of fires and lights; instructions for leaving horses behind for the time being; for wading through shallow water on entering and on leaving pontons; for the general conduct of supporting and covering troops and of posts already stationed at the river; for the uniform to be worn by covering troops; for the supply of ammunition and rations; for the despatch of bridge trains from ferry points to the bridge site, etc.

In case of a difficult crossing, it may be a good plan to give the leaders special sketches or reproduced maps and to issue the carefully arranged details and dispositions for bridge work in written form. But the danger that in the press of circumstances lengthy instructions may not be read carefully, should be guarded against. The following dispositions were made for the crossing to Alsen.[1] (See Fig. 18.)

As has already been pointed out, orders should not be issued prematurely, but they should, on the other hand, be issued early enough to enable the troops to understand them thoroughly and to make some preparations for their execution.

The orders from higher authority are supplemented by separate orders issued by the commanders named in the distribution of troops, especially that issued by the senior pioneer officer to his pioneer units. In all these the same principles govern as in the orders emanating from higher headquarters.

PREPARATIONS FOR THE CROSSING.

Mention has already been made of the necessity of giving the whole enterprise a broad technical foundation, i. e., of placing in readiness, in plenty of time, a sufficient number of pioneers and an ample supply of service bridge equipage and, when necessary, of improvised material. In this place, it is only desired to discuss the appropriate distribution of technical personnel and matériel. The military axiom, to put in the bulk of one's means at the point where success is to be won, is applicable to river crossings also. It would be a mistake, therefore,

[1] See "Gefecht an Fluszübergängen," by Cardinal von Widdern, II, p. 151.

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CROSSING POINTS.

	A	B	C	D
Width of Alsen Sound	520 m.	900 m.	900 m.	1120 m.
Ferry material	50 boats	42 boats (3d Ponton. Col.)	29 boats	42 boats
Capacity at a single trip	750 men	600–700 men or 130–140 troopers & 16 guns.	400 men	750 men
Disposition of the pioneers; commander.	Capt. Adler men 1. 1st Co. 2d Pio. Bn., 95 2. 3d Co. 3d Pio. Bn.. 60 3. Inf. oarsmen.....170 325	Capt. Schütze men 1. 1st Co. 3d Pio. Bn., 100 2. Pon. Co. 4th Pio. Bn..... 95 3. 2d & 4th Cos. 3d Pio. Bn.....165 4. Inf. oarsmen.....340 700	Capt. Thelemann men 1. 3d Co. 3d Pio. Bn.. 40 2. Inf. oarsmen.....170 3. Vol. civilian oarsmen..... 8 218	Capt. Manthey men 1. Pon. Co. 5th Pio. Bn. 95 2. Pon. Co. 7th Pio. Bn.....160 3. Inf. oarsmen.....185 440

TROOPS TO BE FERRIED ACROSS.

1st Echelon	Regtl Hqrs & I. Bn. 24th Inf.	II. Bn. 24th Inf.	Bn. Hqrs. & 2d & 4th Cos. 64th Inf.	III. Bn. 64th Inf.
2d Echelon	Regtl Hqrs., 1st & 3d Cos. 64th Inf. & Hqrs. 6th Div.	II. Bn. 64th Inf. Arty & Cav.	Bn. Hqrs. & 10th & 11th Cos. 15th Inf.	II. Bn. 15th Inf.
3d Echelon	II. Bn. 55th Inf.	Hrqs. I. Army Corps & III. Bn. 55th Inf.	9th & 12th Cos. 15th Inf.	3d Jäger Bn.
4th Echelon, etc.	Schmidt's and Canstein's Brigades			I. Bn. 55th Inf.

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to expend too much in secondary operations, and it would be equally wrong to hold out reserves when the launching of all the force in the first line would more surely guarantee success. This is especially true of the employment of pontons in ferry service, for too many can not be designated from the very outset for this work. If one divisional bridge train is kept in reserve for initiating the bridge work, i. e., is not used to ferry troops across, this will suffice in most cases. By the time this

Fig. 18.
The Crossing to the Island of Alsen.

has been brought up, unloaded, and its matériel built into the bridge, the first bridge wagons of the other trains, of which only the pontons were unloaded at the ferry points, will have arrived. The progress of the construction work on the bridge will thus not suffer any delay, if provision is made for gradually withdrawing the pontons from the various ferry points.

It may or may not be a good plan to equip one of the ferry points with an abundance of ferry equipment. Local conditions on our own or on the hostile side of the river, the evident dis-

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tribution of the hostile forces, or the chance to support the crossing with telling effect by artillery, may determine how many pontons shall be assigned to the various ferry points. But, in general, an equal distribution of the pontons will be advisable, so that strong bodies of infantry can be quickly transported across at each of the chosen ferry points. The entire enterprise will then be less dependent upon the success achieved at a single, main ferry point. To be sure, the character of the near river bank—the presence of bays, harbors, islands that favor a concealed launching of the pontons, is often inducive to unload a lot of ferry equipment at such points. But the enemy will recognize points so favorable for the attacker just as well, and may mass troops and post searchlights, etc., opposite them and thereby make it especially difficult to achieve success there. Just imagine what havoc a platoon of field artillery could create if it were posted well concealed on the river bank by the defender, opposite a harbor entrance and, aided by a searchlight, opened fire on the channel as soon as there were indications that ferry service was about to begin.

Special care should be taken in preparing trains and pontons in order that they can be used as noiselessly as possible in proximity of the enemy. The dull rumbling noise produced by a ponton train in motion attracts attention far and wide. If peace experience is any guide, a train, to be secure against discovery, will not be able to approach nearer than 800 m. to the hostile position on the opposite bank unless very favorable weather conditions exist. If a train moves at a trot over hard chausées or over wooden bridges, the rumbling noise will be heard still farther away. The noise is primarily caused by the bumping of the pontons on the hard wagon bed and by the bumping of the wheels against the axles. Nothing much can be done to prevent this. To cover the wheels with straw, etc., is of no value as the covering will be chafed off in a very short time. The blow of the pontons against the beds may be slightly reduced by cushions of rope (anchor cables) or by bundles of straw placed between pontons and balks. It is even of some little value to use for this purpose the oarlock slings employed to reduce the noise of rowing. That it may be desirable to cover hard pieces of road with straw, manure, etc., has already been mentioned elsewhere.

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A far more promising field than that of reducing the noise of moving trains, lies in the preparations that must be made to make the handling of the pontons at the river bank and in the water as noiseless as possible. The use of rope slings to replace the oarlocks, has already been mentioned. But all rattling parts of the older types of pontons—especially rings, should be wrapped. Otherwise the noise made by them will betray all movements of the pontons. It may be desirable to put straw in the bottom of the pontons used for ferry service, so as to minimize the noise made by men entering same. That it is necessary to keep all horses at a sufficient distance from the river until the result of the initial crossing is known, so that they will not betray the operation by neighing, is well known.—Pontons should, moreover, be equipped with the means of quickly repairing leaks caused by bullets.

The importance of good road communications has already been pointed out. It may, sometimes, be necessary to repair the roads before nightfall. But such repair work is always inadvisable if it might attract the attention of hostile patrols or scouts and cause the surprise to fail. It is very desirable to hold infantry in readiness at bad places in the road to help the carriages across them.

The marking of roads leading to the river so that they can be found at night forms another feature of the preparations. The simplest way of doing this is to station non-commissioned officer's posts at cross roads to await the various columns of troops, officers, messengers, etc., and to have them guided by men detailed for the purpose to the next post. Carefully shaded lights will facilitate finding of these posts. This marking of the roads is of the utmost importance, for military history and maneuver diaries record many instances where troops and trains lost the road, thereby jeopardizing the whole enterprise. During Moreau's crossing of the Rhine at Reichlingen, on May 1, 1800, all technical preparations were completed by 1 A.M., but the infantry did not appear upon the scene until 4 A.M., all out of breath. It had lost the road in the darkness and had been delayed by artillery and trains that were choking the roads. If it had not been for the French artillery, the attempt to cross, which had long ago been discovered by the Austrians, would have ended in failure.

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Any time that may be available should be utilized to instruct the infantry assigned to assist the pioneers, in unloading, carrying and launching of the pontons. If, during very difficult crossings, an opportunity should present itself to give supporting and covering troops some practice in the duties they will have to perform at the outset, this will materially help the success of the crossing operation.

If, in addition, one has taken measures to dispose of the dogs in villages along the route of march and to guard against treachery on the part of the natives, has cautioned the troops to maintain silence and forbidden them to light fires or lights, one will have done all that is possible in the way of preparation. The rest depends upon the troops and lies in the lap of the gods.

CONDUCT OF THE CROSSING.

It is not intended to discuss technical details in this chapter, for they form part of the stock in trade of the pioneers. Neither is it desired to lay down a hard and fast method for surprise crossings. A mere glance at military history, which records a multitude of crossings widely different from each other, would demonstrate the futility of such an attempt. The strategical and technical situations, the conduct of the enemy, our own strength, local conditions, supply of ferry and bridge matériel, etc., influence the solution of one and the same problem to such an extent that, to lay down any iron clad scheme, would be preposterous. Only the most difficult problems, such as arose, for example, in the crossing at Alsen and at Dietikon, will be more closely investigated and those questions discussed in particular, that, according to experience, are most liable to give rise to differences of opinion.

As the general course of such crossings has already been discussed, familiarity therewith may be assumed.

Arrival of the Troops at the Crossing Point.

The order for crossing a stream has a very definite object in view, to accomplish which it contains various detailed instructions. It is absolutely essential that it be executed in its entirety, not only in what it specifically directs, but also in what it silently presupposes, viz., that the enterprise will make rapid progress

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and that the technical work, especially that done on the bridge, will be reliable. If the order can not be carried out, this failure should, under no circumstances be the fault of insufficient reconnaissance and preparation. Both, as already so often emphasized, require time, but it is a basic fault that the time available is never fully utilized. And this, especially during the final stage of the preparations at the river, is often overlooked. The wish to give the troops sufficient rest during the night and to have them fresh and in good condition for the hardships awaiting them after they have crossed, is quite natural. But it must give way before the desire to be completely ready in time under any and all circumstances. One must be absolutely certain that, no matter what delays and what friction may develop, everything has been done to carry out the order punctually and completely.

This applies primarily to the pioneers, to the troops to be ferried across first, and to the supporting troops. It is absolutely essential that the pioneers with their trains arrive punctually in the vicinity of their area of usefulness. Nothing is worse than hurry during the final stage of the preparations on the river bank. It is far better for the pioneers, after completing their work to rest beside their pontons at the water's edge, ready for further labor, and for their leader clearly to think over once more during the last hour the task that awaits them. The danger of discovery apparently grows with premature starting of the preparatory work. But how far this is borne out by military history can not be determined, and our maneuver experiences do not substantiate this view. The steadiness with which work can be done if time enough is taken, explains why better progress can be made if there is silence and secrecy.

The pioneers must have absolutely reliable communication with their bridge trains so that (while already brought as close as possible to the place where they are to be used), their punctual arrival will be assured under any circumstances. Field exercises demonstrate that this rule is more often honored in the breach than in the observance. It is inadvisable to have the trains march for long distances over dirt roads. Detours over good roads often lead more quickly to the objective.[1] When the

[1] The bridge trains needed for the crossing of the Schlei at Arnis, in February, 1864, made a march of 15 km., in seven hours.

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roads are bad, the trains may be escorted by a company of infantry, which should assist them and is responsible for their punctual arrival. All troops should be instructed to assist the movement of bridge trains in any manner possible.

Like the pioneers, the supporting troops (artillery and infantry) and the leading echelons of the covering troops must arrive punctually at the ferry points. They should orient themselves promptly and thoroughly, occupy their positions and should then be distributed for the first ferry trip. But, before the ferrying commences, they will be able to take quite a rest, which will be of advantage to them later in their subsequent work.

It is different with the echelons that are to be ferried across later on and with the troops that are to cross the completed bridge. To bring them up too soon would be a mistake, as any unnecessary massing of troops at the crossing would prematurely betray the whole undertaking.

The Best Time for Ferrying Troops Across.

A dark night offers the best chances for ferrying troops across without discovery. In an essay treating of the Russian crossing at Simnitza, General von Liegnitz, therefore, recommends that ferrying should begin three or four hours before dawn.[1] This procedure may have great advantages if one contemplates ferrying troops across at one point only, meets nothing but weak hostile advance troops there, forces them back quickly and awaits possible counter-attacks in a defensive position at the river, in fine, if the troops thrown across do not have to carry out an offensive movement of some magnitude on the opposite bank. In case the defender does not wish to suffer the enemy on his side of the river, he will have to assume the offensive, and this will encounter considerable difficulties in the darkness. The attack of the whilom defender will be directed against positions that he can not make out accurately; his artillery will not be able to function in the darkness; and, meanwhile, his opponent will bring more and more reinforcements up and will begin with the construction of the bridge. All the uncertainties incident to night operations will inconvenience the whilom defender; they may even influence him to such an extent that he

[1] See General von Liegnitz, "Fluszübergänge," in "Kriegstechnische Zeitschrift," 1904, p. 273.

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will desist from advancing energetically during the rest of the night; but in the morning the bridge may, perhaps, have been completed, and with that the prospect of a successful defense of the river line will have been considerably diminished. To be sure, it should be remembered that during night crossings effective fire support from the near bank of the covering troops thrown across is impossible and that bridge construction in the night time is, according to experience, much slower than that effected in the day time.

The opposite view, not to begin ferrying until broad daylight, is fully justified, as already pointed out, in case the crossing is to be forced under cover of superior artillery.

When, on the contrary, a defensive rôle for the troops thrown across can not be counted upon, and there is a chance for them to coöperate with each other in attack or in quickly seizing hostile supporting points, it will, without doubt, be desirable to do the ferrying at night and to make the attack in broad daylight. It should be borne in mind that the artillery can not take a hand in the fight on the other bank until it is daylight. These principles have governed in most of the surprise crossings that military history records, and thus we find nearly all of them carried out at the break of dawn.

Supporting Troops on the Near Bank.

Infantry supporting troops should not be so posted that they will be in the way at the ferry point and that they will not hamper the movements of the crossing troops. They should, therefore, be posted some distance away from the ferry point, especially below the same. They may be very effectively supported by platoons of artillery or by single guns, unlimbered in the most advanced line, right on the bank.[1]

It has often been found at maneuvers that enough foresight had not been used quickly to render harmless hostile posts that opened fire from a distance upon the ferry point. (See for example, the position of the guns at *a* in Fig. 19.) The supporting troops should, therefore, not be posted at the ferry point alone, but above and below the same, opposite places where hostile posts are known or assumed to be located. In addition, a reserve

[1] During the crossing of the Rhine at Caub, single guns were used in this manner.

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of field artillery, machine guns and cavalry should be kept in readiness, which can be quickly despatched against suddenly appearing hostile forces. Supporting troops should, likewise, be posted in a position from which they can ward off approaching hostile reinforcements.

When there is danger that the supporting troops will be discovered, due to the employment of artificial illumination by the enemy, if they go into position early, they should completely deploy and remain under cover as long as the troops that are to be thrown across, and should then move into their assigned positions at the last moment. In this case, their instructions

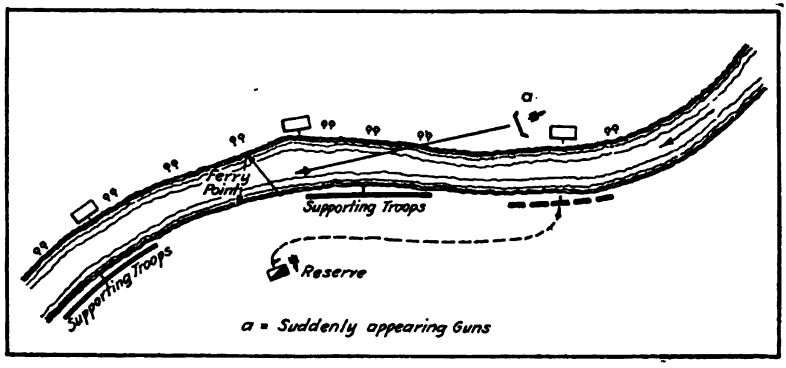

Fig. 19.
Position of Supporting Troops.

should be not to open fire until the first echelon across encounters serious resistance that it can not break down at once unaided, preferably with the bayonet. As far as practicable, no attention should be paid to fire from small hostile parties. When the supporting troops must take a hand in the fight, however, they should do so vigorously. Events on the opposite bank should be followed with the utmost care, so that friend may be distinguished from foe in the darkness.

When once the opposite bank is under complete control of the covering troops, the infantry of the supporting troops, which in most cases is taken from the same organizations, may be thrown across for their support.

In general, too much artillery can not be detailed to support the crossing and if heavy artillery is available, it should be used

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likewise. This supporting artillery should not go into the positions reconnoitered for and assigned to it during the day, until all danger is passed of betraying the undertaking by its movements. Good communications between the commander and the ferry points are essential. The artillery should open fire when it is no longer important to hide the location of the ferry points from the enemy, and then becomes the most valuable factor in achieving success. While it is still dark, it should sweep the distant foreground on the opposite bank (by searching fire) and should also direct its fire against supporting points (for example, villages) that are especially valuable to the defender. During the day, it should assist in the really critical phase of the river crossing, the counter-attack made by strong hostile bodies against the covering troops that have been ferried across and that are being reinforced gradually only.

Covering Troops.

At each ferry point, the ferrying should be begun on as broad a front as possible and for the initial trip all pontons, ferries or skiffs should leave the bank simultaneously, if practicable.

The troops must wade a bit through shallow water on entering and leaving the boats, otherwise the crossing will be unduly retarded. It is even eminently advisable specifically to mention this in the order. At Alsen, the troops waded 40–60 m. before entering the boats.

How long the ferrying should be continued and when pontons should be gradually withdrawn from the ferry points and used in bridge construction, are purely technical questions that the leader must answer. Even when the further, rapid reinforcing of the covering troops appears desirable to him, he should bear in mind that the bridge work can not go on if the necessary pontons are lacking.

If none of the preparations have been discovered by the enemy, final discovery of the movement by the hostile river guard will depend upon the degree of darkness, upon the presence of fog, and upon the noiselessness with which the whole operation is executed. At Alsen, the operation was discovered when the boats had covered 200 of the total distance of 600 m. During an extensive field exercise held in the 1st Pioneer Inspection District, the crossing over the Vistula at a point where it was some

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400 m. wide, was so favored by darkness that two-thirds of the stream had been traversed before the movement was discovered. It is said that at Simnitza, the Russians managed to approach within 100 m. of the Turkish bank without being fired upon.

The distribution of infantry among the pontons raises some difficulties for the first trip only. If the troops are at hand, the loading of subsequent echelons proceeds without noticeable friction, even if, as is the case when broad and swift rivers have to be crossed, each succeeding fraction has to embark farther down stream. (See Fig. 20.) If one desires to avoid such a shifting of embarkation points which, by the way, is impossible in any case until the hostile bank has been entirely evacuated by the hostile troops after the initial, successful crossing, numerous towing detachments must be stationed at least on one bank to expedite the movement of empty pontons to the embarkation point. On very swift and wide rivers (such as the Rhine and the Danube) one can count upon the boats being carried down stream at each trip a distance at least equal to the width of the stream.

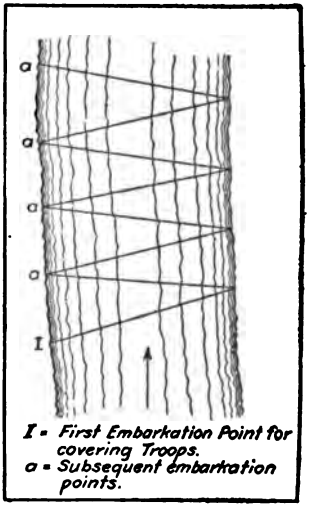

Fig. 20.
Embarkation Points in Swift Current.

It appears by no means impossible that in the future numerous power boats will be utilized in difficult crossings over wide streams. During the technically very difficult crossings over the Danube in 1877, steam launches were frequently used.

Upon arrival at the far bank, the men should at once assemble and commanders should get their units in hand. It is, therefore, better to throw entire companies across at once than several companies abreast. In making arrangements for ferrying troops across, it should be borne in mind that proper tactical units must be reëstablished on the opposite bank. All troops thrown across at once come under the orders of a common superior.

But what about the conduct of these troops after their arrival on the opposite bank? During maneuvers one usually sees the

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reassembled companies move forward and disappear in the darkness, in order quickly to reach a position beyond which, according to orders, they are not to advance. A tactical situation, as outlined in the following sketch, is then very apt to arise. (See Fig. 21.) Strong hostile bodies stationed in the vicinity of the river, meantime alarmed, then advance in the darkness in rear of the attacker's troops without colliding with them, and turn toward the river bank. If they accidentally strike the bridge site, where the trains have meanwhile arrived and the construction of the bridge has begun, their fire would, in an actual case, produce indescribable havoc that might seriously retard the bridge work and produce heavy losses.

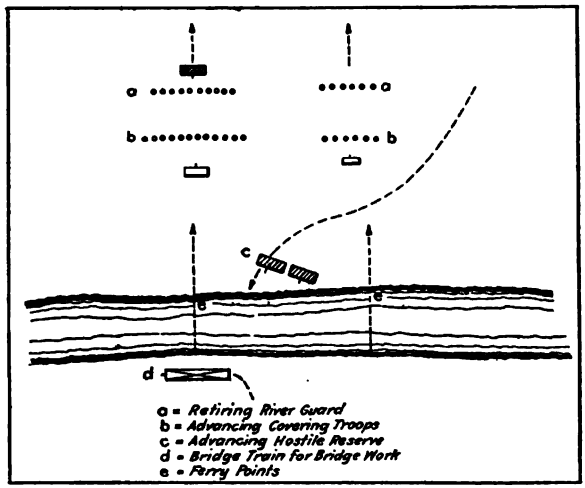

Fig. 21.

Improper Conduct of the Covering Troops.

Such conduct on the part of the covering troops on gaining the opposite bank would be highly improper. They should, in the first place, cover their own ferry points for the crossing of succeeding echelons, even if they do this with small detachments only. (See *b*, in Fig. 22.) Then they should endeavor to facilitate the crossing of neighboring units, and finally protect the bridge construction work, which will have begun meanwhile. For this last purpose an extensive use of intrenchments may, perhaps, be in order. To accomplish all this, they should close

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in toward the bridge site and should not occupy more ground in the direction of the enemy than they can command with certainty. The arrival of other echelons will enable them to gain ground to the front and the gradually dawning day will, in addition, permit them to extend still farther. A hostile advance in the direction of the bridge site must be prevented at all hazards. As soon as the commander of the covering troops believes that he can effectively protect the bridge site, he should report that fact (by prearranged signal). When this report is received, and not until then, the trains are brought up to the river bank.—The tasks of the covering troops thus appear to be

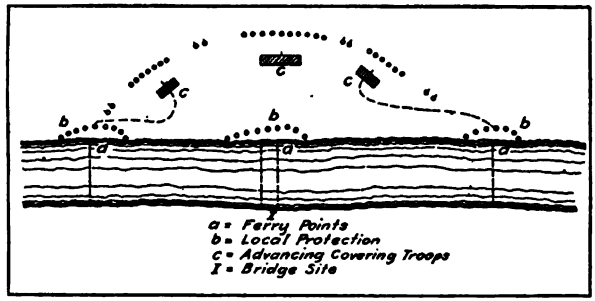

Fig. 22.
Correct Conduct of the Covering Troops.

primarily restricted and, in the main, defensive in character. But from this it is by no means to be inferred that, in individual cases, it would be improper to order such troops to attack, seize, and occupy terrain some distance from the river, for the purpose of depriving the enemy of important supporting points that may be of decisive importance for the advance of the troops or in a subsequent engagement. This is especially true where commanding heights are situated on the opposite bank, which must be in the possession of the attacker before the construction of the bridge may be considered as adequately protected.

It is sometimes a good plan not to start crossing at all ferry points simultaneously, but to start earlier at the point where the best chance of success is believed to exist. The troops already across can then materially facilitate the crossing of the following units by advancing against flank and rear of the enemy. Hence, one usually likes to delay ferrying at points where the opposite

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bank is known to be very strongly guarded. A timely crossing at one point may likewise attract the local hostile reserves and cause the troops crossing somewhat later at other points to encounter less resistance.—Such a highly artificial mode of crossing as that suggested should not lead to the conclusion that a weak-kneed procedure is preferred. In the end, even with the most careful preparations, a good deal depends upon daring and impetuosity, which will win success even if a superior enemy is encountered.

One will, as a rule, have to be content with throwing only infantry across,[1] which should be accompanied by its machine guns, the latter without carriages. The crossing of field artillery consumes a good deal of time, and should, therefore, not be attempted, unless it can not be avoided. In some cases, it suffices to ferry but one team across, which can then bring the various guns into position as they arrive. It may become necessary, however, to throw observers across the stream to observe the targets for the artillery that remains on the near bank.—As the infantry will not be able to dispense with its horses in the long run, they should be transported across as soon as a sufficient number of covering troops is on the opposite bank. It will likewise be necessary to send a few troopers across for messenger and patrol service. The combat trains can not follow the troops, as a rule, until the bridge is completed. Ammunition should be issued before the crossing begins. At Simnitza, in 1877, eight life-saving pontons were likewise provided which also transported medical personnel and medical stores to the south bank of the Danube. The signal troops should promptly provide for telephone communication across the river between the commander and the covering troops, and, at the very least, should provide quickly for visual signal communication.

That hasty bridge material should be taken along by the covering troops in case minor water-courses may hamper movements on the opposite bank, has already been mentioned. It is claimed that at Simnitza, ladders were needed to surmount the steep river banks. In any event, if the landing on the opposite bank

[1] A French company of 150 men, armed with nothing but pistols, pikes, and sabers, on September 25, 1799, swam the Linth (50 m. wide) for the purpose of surprising the enemy, which turned out to be a rather difficult undertaking.

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is likely to be in any way technically difficult, strong detachments of pioneers, equipped with sufficient tools and improvised material of various kinds, should accompany the first echelon thrown across.

The Construction of the Bridge.

It is only in the case of an exceptional crossing like that here described that nothing need be done but to ferry troops across when a small force suffices to meet the problems on the opposite bank. At the very least, good ferry service or a flying bridge should be established to improve the communications to the rear.[1]

As a rule, however, the whole operation depends upon the construction of a reliable bridge. This is almost invariably necessary for the progress of subsequent operations. Speedy construction is desirable in order to reap all the advantages accruing from the surprise of the enemy and to relieve, as quickly as possible, the pressure on the covering troops on the opposite bank, which may be in a very critical situation. Everything, therefore, that will accelerate construction work is highly important. While it is not desired to go into details, a few points may be emphasized that are not always sufficiently observed.

As soon as the first covering troops have made a lodgment on the opposite bank, a reconnaissance detachment of adequate strength and equipped with the requisite material should be thrown across the stream at the bridge site for the purpose of definitely determining the condition of the approaches leading down to the river on the opposite bank. Arrangements should be made beforehand as to how this detachment is to report in a simple manner in regard to the most suitable route leading from the bridge, i. e., the best line for the bridge. These reconnaissances will not delay the construction work, for that can not begin anyway until at least the second echelon of the covering troops has landed on the opposite bank and a report has been received that the bridge site itself appears to be adequately

[1] In the case of the French force thrown across the Rhine in an enterprise against the fortifications of Kehl, on June 24, 1796, such a flying bridge was considered sufficient. It was built in an arm of the Rhine south of Strassburg and was floated into the main channel simultaneously with the first troops thrown across, and opened for traffic six hours later.

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protected. The bridge trains, to be sure, while placed in march at a timely moment, toward the bridge site, will not be allowed to appear prematurely on the river bank but will be held back instead under the nearest available cover. It may be advisable, however, to move a few bridge wagons to the river in order to begin work on the shore end of the bridge, which is frequently rather complicated.

That bridge wagons, after unloading their pontons at ferry points, should independently march to the bridge site has already been mentioned. The trains must reach the bridge site as speedily as possible, but should not leave the ferry points before the first trip of the covering troops across the stream, if there is danger that their movement may prematurely betray the operation.

The great importance of good road communication on both banks has been repeatedly emphasized. Timely repair work—usually performed by troops specially detailed for the purpose, is often neglected. Several approaches should be provided at each end of the bridge in case it becomes necessary to close one or the other approach for the purpose of making repairs.

It is also exceedingly important to protect the bridge against floating objects. That the Austrians succeeded in destroying the bridge over the Danube before the battle of Aspern, by floating objects against it, thereby depriving Napoleon of a victory, is well known. As a rule, danger from floating mines need not be apprehended, but protection must be provided against floating trees, rafts and loaded vessels. Extensive measures must be taken to guard against these. Power boats will, in all likelihood, be able to render valuable service in this connection.

The completed ponton bridge should be operated by strong detachments of pioneers who not only observe and safeguard it during the passage of troops, but who must likewise hold themselves in readiness to repair damages as quickly as possible and to take appropriate measures to protect the bridge in case of high water. In the case of bridges over wide streams, this will require several pioneer companies. These may be detailed from second line troops and may be reinforced by details from the other arms. Additional technical troops may be needed for protecting the bridge against floating objects, for repairing and

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keeping roads in shape, and for constructing intrenchments in the nature of bridge heads. For this work, likewise, Landwehr or Landsturm troops, or labor companies under the direction of military engineers may be utilized, so that the advancing troops may not be deprived of any more of their pioneers than is absolutely necessary.

A completed bridge will have to be provided with a reserve of bridge equipage for river guard work and the service of security, for reinforcing the anchoring promptly, and for repairing extensive damage quickly. It may even be advisable to operate a reliable flying bridge beside the ponton bridge. This flying bridge could be used for transporting very heavy loads and would serve as a substitute in case accidents or the enemy interrupted traffic on the ponton bridge. Power boats can be used to good advantage in connection with bridge service.

Whether it will be necessary shortly to replace a bridge built with service equipage with one built of improvised material will depend upon existing conditions. Preparations for such substitution should, however, be made, if practicable, while the ponton bridge is being built, unless with commendable forethought improvised material of all kinds has already been placed in readiness and sent after the troops.

FEINTS AND SECONDARY OPERATIONS.

The extraordinary difficulties of surprise crossings appear even at maneuvers. In war they will prove still greater in view of the defender's modern armament, means of reconnaissance, communication and illumination, and the natural lack of experience of perhaps most of the troops participating in the crossing. In view of these difficulties, it is obvious that the attacker will do anything in his power to keep strong hostile forces from striking the covering troops thrown across.

Feints and secondary operations are the logical result. They are designed for the express purpose of drawing the main hostile forces upon themselves and away from the principal crossing point. Feints to cross are to create the belief that a crossing is actually contemplated at the point where they are made. In secondary operations, on the contrary, a crossing is actually effected even if only meagre technical means are available. If the attempt succeeds, a skillful leader will still be free to make

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the principal crossing at the point where the secondary crossing succeeded. But one should guard against artificialities and not allow oneself to be induced to take half-measures at the selected principal crossing point in favor of a secondary one.

It is remarkable to what an extent feints may influence and warp the judgment of the defender. When once apparently certain indications have made him believe that he has divined the intentions of the attacker with reference to a certain crossing

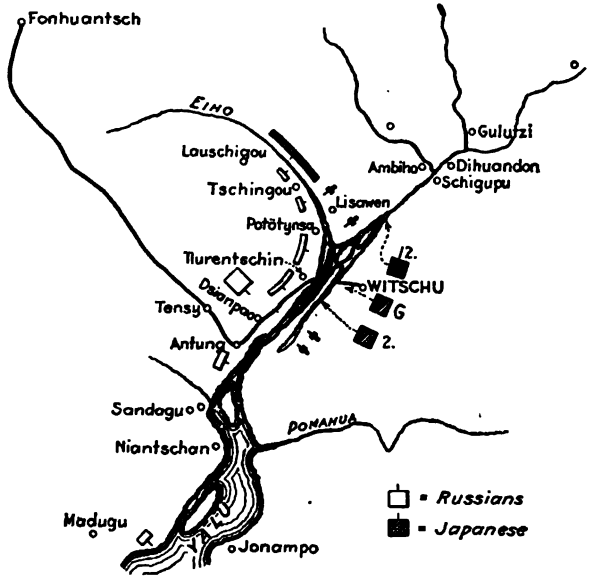

Fig. 23.
The Crossing of the Yalu.

point, it will take very weighty reasons to make him change his opinion.

At the Yalu (Fig. 23), the Russians confidently expected a crossing to be made southwest of Witshu. Nothing could shake them in this belief, not even the construction of several improvised bridges over the arms of the Yalu north of that place. When they finally discovered their error, it was too late, and the feeble attacks launched by them could no longer prevent the completion of the Japanese crossing.

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At the Beresina (Fig. 24), Napoleon sought to induce the Russians to believe that he contemplated a crossing below Borrisov, a point admirably located for the continuation of his retreat. The mass of unarmed stragglers were put in march toward this point and the news spread among the natives with seeming carelessness that the French army would cross at Borrisov. This information reached the Russians in due time. They consequently focused their whole attention upon this point and concentrated the bulk of their forces there, sending nothing but a small detachment to Studjenka where—16 km. from Borrisov, the French army actually effected its crossing.[1]

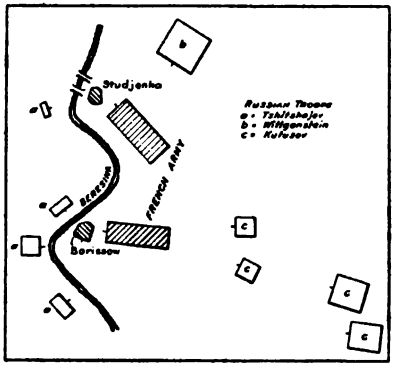

Fig. 24.
The Crossing of the Beresina, Nov., 1812.

A detailed description of the crossing of the Beresina may be found in "Mitteilungen über Gegenstände des Artillerie und Geniewesens," 1913, p. 9 et seq.

One example from a maneuver will now be described just to demonstrate with what obstinacy preconceived notions are frequently maintained. During a field exercise on the Oder, in the 1st Pioneer Inspection District, a pioneer officer, contrary to the intentions of the commander and twelve hours before troops were thrown across, crossed the river with a platoon at an unguarded point at which the crossing was later on to be made, and began to repair the approaches to the crossing. He was surprised by cavalry and placed out of action by a company of infantry that had hurried up.—Nevertheless, this suspicious

[1] Before the battle of Aspern (September 20–22, 1809), the entire attention of the Austrian headquarters was firmly fixed on the terrain around Nuszdorf (13 km. northwest of the subsequent crossing point), where on September 15th, Napoleon's attempt to cross the Danube had failed. It was expected that the French would make a renewed attempt to cross at this point. The real crossing point at the island of Lobau was not discovered until very late. This shows that even unsuccessful attempts at crossing a stream may be used to mislead the enemy. (For details see, "Mitteilungen über Gegenstände des Artillerie und Geniewesens," 1912, p. 1209.)

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circumstance failed to induce the commander of the defense to include this threatened point within his permanent lines. He believed that the crossing would be made at another point, kept his forces concentrated there, and was completely surprised when the crossing was actually made.

It is a mistake to look upon feints as an unimportant and final part of the preparations for a surprise crossing. As a matter of fact, they should begin with the arrival of the first reconnaissance detachments at the river. The patrols should show themselves on a broad front—except at the point that, according to the map, has been tentatively selected for the crossing, even at points where the attacker has no idea of crossing later on. After the point at which troops are to be thrown across has been determined, one should endeavor to warp the judgment of the defender more and more and divert his attention from the principal crossing point. This may be done at the locality where the feint is made by the manner of reconnoitering, by the distribution of troops and by other means suited to the case in question and which need not be further discussed in this place. But it would be positively harmful to make such devices too obvious. It would, likewise, be useless to attempt to draw the defender's attention to points where the tactical and local conditions for a crossing are too unfavorable. In all civilized countries, the extensive railway net will make it possible, in case of need, quickly to transport troops that were used for feints or that were intentionally kept away from the stream for the purpose of deceiving the opponent, to the principal crossing point.

If it is desired to crown the feint with a secondary crossing, a proceeding that is by no means necessary in all cases—and neither at the Yalu nor at the Beresina were such crossings made, pioneers and bridge trains will have to be used very sparingly for this purpose, for they can usually not be dispensed with at the principal crossing point. But strong bodies of other troops, especially artillery not participating in the operations at the principal crossing and destined to cross the completed bridge, can be used to good advantage in such secondary enterprises. The coöperation of artillery is especially desirable in secondary crossings because it can draw the enemy's attention upon itself by its fire and can effectively support the troops thrown across in case they have drawn strong hostile forces upon themselves and have thereby become involved in a critical situation.

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Secondary crossings should be effected before the principal one in point of time. The defender must be placed in a position where he will be compelled to despatch troops to oppose the secondary crossing. To that end, reports of attempts to cross must reach him from the point where the secondary crossing is to be effected and from nowhere else. The principal crossing should be commenced after the hostile columns have already been put in march toward the secondary crossing, but before the enemy has discovered the real nature of that undertaking. In time of peace, secondary operations of this kind are rarely successful. Their real character is too quickly discovered as the opponents are too well informed as to each other's strength. But in war, the commander defending a river line, whose task is at best an exceedingly difficult one, will scarcely hold his reserves back when he receives information that the enemy has already crossed over to his side of the river in considerable force. Military history, at any rate, records the fact that feints and secondary operations, even when they occurred days before the principal crossing, kept the defender on the qui vive, caused him to dispose of his forces improperly, and accustomed him to such an extent to attempts at crossing that, in the end, he failed to discover the principal crossing until it was too late. Modern means of communication will, no doubt, better the defender's lot, but, according to experience, reports in regard to hostile night operations are, as a rule, grossly exaggerated and are apt to induce him to make blunders.

Whether the troops thrown across during secondary operations can join in the main action on the hostile river bank, will depend upon the tactical situation. Sometimes, especially in the vicinity of fortresses, secondary operations may be staged where they will threaten the communications of the forces guarding the river line.

CONCLUSION.

The foregoing dissertation shows the great diversity of the situations under which river crossings may be made. One thing will, no doubt, have been demonstrated, viz., that the bulk of the preparatory work of the enterprise falls primarily upon the pioneer officer, not only upon the senior officer of that corps, but upon every officer participating. His peace training makes

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him, par excellence, the man upon whose technical skill the commander-in-chief will primarily depend. But that commander will not have confidence in his subordinate unless the latter is practical and possesses a clear conception of strategical operations, sound tactical judgment, keen foresight, tireless energy, and unquestioned courage. If, in addition, the commander himself, has a clear conception of the task that confronts him, and a proper appreciation of its technical difficulties, the whole enterprise will have been entrusted to good hands. The troops participating—pioneers excepted, will only in exceptional cases have had an opportunity to take part in river crossings in time of peace. Their enthusiasm, which always seems to be particularly lively during unusual operations, must help them to surmount any difficulties that they may encounter. Their dash, impetuosity and stubbornness will have to stand the acid test of reality. But all this does not suffice for their leaders. Very considerable and in times of peace frequently underestimated demands will be made upon their professional skill. Personal dash and reckless leading of their troops into the thick of the fray must supplement professional knowledge, to be sure, but can not replace it. This still offers a wide field for peace training.

Upon our pioneers, we shall be able to rely. Even after extraordinary exertions, they will not fail us, just as they did not fail us in 1864 and again in 1870–71. They will not lag behind their French and Dutch comrades in arms who, working immersed up to the breast in the icy waters of the Beresina, saved an army. They know as they work at night that a glorious day dawns for them and all they need is careful, sound, and bold leadership to do their whole duty well and to satisfy their ambition.

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DEFENSE AGAINST A HOSTILE CROSSING.

KINDS OF RIVER DEFENSE.

It was necessary, in discussing river crossings, to touch upon the defense against such operations in order that a large number of measures taken by the attacker to accomplish his object might be the better understood. In the following pages, the tactics and technique of the defense of river lines will be discussed in general terms.

It is not intended to discuss in detail the value of river lines to the defense. This would, therefore, eliminate all that appertains to the strategical use of river lines, such also as applies to a battle seeking a decision (for example, Aspern, Katzbach), and particularly all that which is generally understood by the term "indirect defense of a river line." This, likewise, applies to questions as to the value of fortresses and bridge heads located on river lines, and the defense of a stream by an offensive of magnitude on the opposite bank. It is proposed to investigate in a general way what tactical principles should be observed and what technical means should be applied when the problem consists of "absolutely preventing the enemy from crossing a river for either a short or a long period of time." In other words, when it is less a question of a fight at river lines than one of making use of them as an obstacle to the hostile advance, which, to be sure, frequently initiates the fight for river lines.

There are two kinds of river defense, and they are diametrically opposed to each other. The first, used frequently in the past and failing, in the end, as often as it was used, consists of a purely defensive, cordon-like barrier at the river itself and designed solely for the purpose of gaining time. (For example, see Map 3.) This method is criticised because it is claimed that it could never bring about a decisive victory, as it aims to cover everything and thereby completely disintegrates. If it were penetrated at any one point, its entire line would be valueless as the defender would be unable to concentrate his widely scattered forces in time to make an energetic attack.

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The second method is, therefore, very properly given the preference, as it will not only gain time, but decisive results as well. It consists of posting weak forces at the river itself for observation and for warding off the initial attempt to throw troops across, of massing the bulk of the forces at various points in the rear, and of a vigorous offensive against the enemy, as he is in the act of crossing. In this, the crossing of the bridge —which constitutes a defile, lack of room for deployment, deficient reconnaissance on the hostile river bank, unfavorable communication to the rear, etc., will hamper the enemy in carrying out his designs.

This clearly distinguishes the defensive, cordon method from that in which the bulk of the forces is posted some distance from the river with the intention of assuming the offensive, the preference being given the last named method. This preference is justified, in addition, because the commander, in view of the concentration of the bulk of his forces, is less dependent upon the measures of the enemy, need not rely upon the conduct of each and every company and outguard at the stream and, above all else, because a decisive success can not be achieved by a river defense unless it is coupled with the offensive. The cordon system of river defense could, therefore, be entirely omitted from discussion, were it not for the fact that there are situations in which a distribution of the troops along the river appears to be fully justified and in which it would be risky, to say the least, to seek a solution of the problem in posting a weak guard at the river and in massing the bulk of the force at some distance from it.

Such a situation may arise when an inferior force whose flanks are secure, is to prevent a very superior force from crossing a wide stream for any length of time—often for a few days only.

This view does not, perhaps, receive much support nowadays, as the term "cordon system" is in disrepute. But it might, nevertheless, be profitable to inquire whether such a method of defending a river line is not fully justified under modern conditions, in the case in question and in it only.[1]

[1] General von Schlichting (Principles, II, p. 49) seems to agree with this conception. To quote:

"The defender must clearly appreciate which stretch of river, in view of the general situation, it is strategically most important for him to cover directly;

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Clausewitz considers that the cordon system is practicable under certain conditions. Since his day, however, the conditions for an occasional use of the cordon system of river defense have, without doubt, become more favorable. The huge armies of the future, advancing against a stream, can not easily move by the flank, thereby turning the barrier provided by the enemy at the river, without losing considerable time. The limited network of roads compels the attacker to attempt a frontal crossing. If he encounters a strong, dense, hostile line, whose flanks are secure—like the long defensive lines with which we became familiar during the Russo-Japanese war, its power of resistance may be so great, provided it is properly handled, that it can not be vanquished at once. At the very least, lengthy preparations on the attacker's part will be unavoidable, and these constitute time gained for the defender. Small detachments posted at various places along the stream, can be easily turned or brushed aside. The preparations and the execution of enterprises directed against them need not entail any appreciable loss of time.

The extraordinarily increased effect of modern weapons enures very largely to the benefit of the defender of a river line. The slow and uncertain action of the musket and gun of the past has been replaced by the rapid fire of the magazine rifle, the machine gun, and quick firing guns. Under the tactical conditions existing when the immediate river bank is defended, even small detachments, skillfully posted and well intrenched can, in a very short time, vanquish a far superior force, before it can effect a landing on the opposite bank.

But the attacker, likewise, derives some benefit from modern firearms. And he will, without a doubt, make his superiority count in case he is only opposed by small detachments posted on the hostile bank. But whether he will be able to drive away strong, well intrenched hostile covering detachments by fire alone, may well be doubted.

In addition, the other modern technical means, such as aircraft, searchlights, flares, telephones, etc., that facilitate reconnaissance and the discovery of the hostile crossing and enable

which stretch it is simultaneously and secondarily possible to command from a flank position, or at what distance from the river he will be able to oppose an enemy either offensively or defensively, with some prospects of success, after the partial or complete execution of his crossing."

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reserves to be quickly called to the threatened points, will assist in strengthening the immediate defense of the river bank.

On the other hand, the defender's chances of throwing back the opponent after the latter has crossed, by attacking him with large forces posted some distance from the river, will be decidedly diminished. Formerly, the defender, in assuming the offensive, had to contend, in the main, with infantry only, that had crossed alone as its artillery was unable to follow. Now, however, the long range guns of the present day, if at all well posted, can take a hand in the fight without leaving their own side of the river. The attacker will, moreover, take good care to make his attack at a suitable time of day with a considerable superiority of artillery and if, in any way possible, on terrain that does not offer the defender favorable artillery positions. The attacker's artillery fire may be so overwhelming that the bulk of the defender's troops will no longer be able to reach the river at all, so that, in other words, the contemplated offensive will halt before the troops thrown across are reached.

Field intrenchments are, likewise, of far more value to troops thrown across than formerly. An extraordinary amount of protection can be obtained in a very short time, as they can be quickly constructed and as everybody is familiar with their various types. A strong mass of troops will no longer be able simply to overrun the intrenched troops. A slower method of attack will, on the contrary, have to be employed, which will consume time and give the attacker an opportunity to reinforce the troops he has thrown across and thereby to make an advance by hostile masses ineffective.

On the whole, the importance and effectiveness of the cordon system of defending a river line thus appears to be nullified. Aside from this, such a disposition, from what has already been said, need be considered only by forces that, while strong enough effectively to bar a river line against a hostile crossing, are after all, numerically or otherwise (Landwehr, reservists, Landsturm) so inferior to the attacker that it appears hopeless to advance with them against the opponent as he is in the act of crossing. Even if they should arrive punctually opposite a crossing point and should succeed in pressing the enemy back, it may nevertheless be taken for granted that if his troops are numerically far superior and are handled well, he will cross the river at other

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points and will achieve the success that was denied him at the first point, elsewhere.

The cordon system will be successful when employed behind a wide river only. For the sake of argument, let us assume a minimum width of 200 m. In Germany, the only streams to be considered would, therefore, be the Rhine, the Vistula, the middle section of the Danube, the Schlei below Rendsburg, and the lower Elbe. Every narrower obstacle is of such minor importance that it can no longer be looked upon as furnishing effective protection for the troops guarding the river bank. The width of the stream should be such as to force the attacker to show himself for some time in boats to the defender and to expose himself to his fire. If the stream is narrow, and the attacker has once landed suddenly, the defensive line will thereby have been penetrated and will, in consequence, be useless. That the chances of the defender are by no means unfavorable in view of the efficacy of modern weapons, if the stream is wide enough, has already been pointed out. To this should be added the fact that an initial success in warding off a crossing falls very heavily into the scales. If the defender has succeeded in sinking a number of boats or to make them otherwise useless at the commencement of the enterprise, such vessels will be lost to the ferry service. The attacker will not have a reserve of such vessels available at this point right away; he will have staked everything upon a single card.

There is nothing particularly inviting about posting the main forces at the river itself, if they can be turned with ease and rolled up from a flank. Troops so posted, therefore, must have their flanks securely resting either on strong positions held by other troops, especially upon river forts (bridge heads), or upon impassable terrain. If coupled with river forts, whose effective zone is thereby supplemented and extended, a cordon system of posting troops at the river itself appears to be especially advisable. The defender will attempt to get along without having his flanks secured, only in case the marches necessary to turn him out of his position suffice to make the attacker lose as much time as appears desirable to the defender.

These, therefore, are the factors that favor an occasional use of the cordon system of river defense at the present day and the conditions under which it finds application. If the usefulness of

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the cordon system in certain cases be admitted, it will only be necessary to make it tactically and technically so strong in every respect as to give it a chance to withstand even serious hostile attacks. The cordon must be equally strong everywhere. It will not do to devote attention to isolated river sections only and to make the cordon particularly strong there. The troops, especially the reserves, should be so distributed as to enable the defender to appear quickly in sufficient force at any point that need be considered as a possible crossing, otherwise the cordon will be broken at its weakest point. In this respect the cordon is like a chain, which is no stronger than its weakest link.

The use of the cordon system of river defense may be regarded as exceptional, being justified only in case sufficient time is available for preparation. It would appear to suffice, therefore, merely to mention in passing the details of the measures to be taken for it and the technical means at its disposal,[1] were it not for the fact that both play a certain rôle in every resistance that troops—even a single patrol, are to make at a river course. One should be thoroughly conversant with all the means available for defense, so as to be able to choose the most suitable one and in order not to violate at least the principles of river defense, if under other conditions, with fewer troops and without lengthy preparations, one is to make a crossing over a watercourse as difficult as possible for the enemy.

The cordon system of defense will, therefore, be discussed first.

I. POSITION OF THE MAIN FORCES AT THE RIVER.

(Cordon System.)

(See Maps, Nos. 1, 3 and 4.)

Distribution and Tasks of the Troops.

The stretch of river to be defended should invariably be divided into sectors whose defense is entrusted to the larger units, brigades and divisions. Each sector should be subdivided as far as is required, into sub-sectors, each defended by a regiment.

[1] Nothing is said of the use of gun boats and sea-going vessels in river defense, as their use enters only in case of the defense of wide rivers and river mouths. Anchored mines as barriers will, no doubt, be used in such cases only.

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This requires not only adequate distribution in depth, but a further division of front. In the regimental sectors, battalions and companies on outpost duty are posted abreast and in rear of one another, supports with their outguards being posted farthest in advance, at the river itself, and charged with the service of security.

Regiments have been selected as the tactical units of defense, because the stretch of river assigned them is not so large as to prevent their reserves, which are quite large, from reaching any point in the sector quickly. If brigades or divisions were

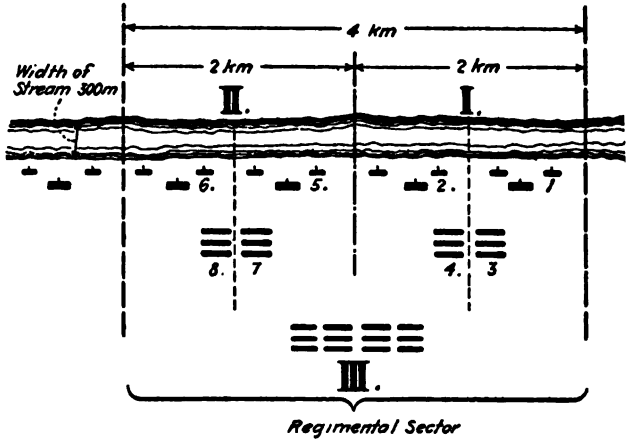

Fig. 25.
Defense of a Seriously Threatened Regimental Sector.

designated as tactical units of defense, their reserves would arrive too late in case they were needed, on account of the longer distance they would have to march. It goes without saying that the higher commanders will desire to exercise some influence on the course of the action, and they should therefore keep out a part of their force (especially artillery) as a reserve. But it is characteristic of the defense of a river line that tactical reserves must, above all else, be provided for the smaller units, for companies, battalions, and regiments.

If the commander-in-chief wishes to have some means at hand with which to influence the action, he should hold out a general reserve, which, in many cases, should be divided into

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groups. But even this general reserve should not be strong, for too many troops should not be withdrawn from the first line. It is desirable to make the general reserve stronger, however, in case long reaches of river have to be defended, which, from their nature, are less to be apprehended as crossing points, in other words, sections that were but weakly occupied by the defender and that could not be occupied more strongly because of a lack of troops. (See example on Map 3.) In case the enemy turns against such weakly occupied stretches, the commander-in-chief should at a timely moment shift his general reserve to that locality so that it can either reinforce the first line there, or be in readiness to throw back any hostile troops that may have crossed. It is of the utmost importance that general reserves possess great mobility. (In certain circumstances, railways and motor transportation should be used.)

Figure 25 shows the dispositions of a regiment that is stationed at a very dangerous point. A company in the case under consideration covers a front of about one kilometer, and the entire regiment a front of about four kilometers. With these figures as a basis, a division, not counting the reserves held out by it, should cover a front of 12 to 15 km., which does not appear excessive, always provided that it is a question of defending a wide stream.

While the scheme outlined gives an idea of the number of troops required, it should not lead to an improper distribution of troops, i. e., one not suited to the local conditions. As has already been stated, some sections of a river course are particularly inviting to the attacker, whereas there are again others in which hostile enterprises need scarcely be apprehended because of marshy places or other obstacles along the bank. If, therefore, the attacker needs to study the map attentively, before embarking upon his enterprise, this is no less necessary for the defender. He, likewise, should endeavor to ascertain the strong as well as the weak points of his position, determine the length of his sectors accordingly, and dispose his troops with judgment. Thus he may occupy certain reaches of river weakly for the time being, with the intention of reinforcing the troops there with his general reserve, and concentrate his forces more at probable crossing points, especially at those where he fears that the hostile artillery will come into action with over-

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whelming effect. But great care must be exercised, for, according to experience, the attacker often succeeds in effecting a crossing where the defender does not expect it on account of the difficulties of the terrain, and where he accordingly made only inadequate provisions for defense. (Caub.) In case attempts to cross are not precluded, the leading line at least—that is to say, the companies with their outguards, should be equally strong all along the river bank. It is especially inadvisable to count too strongly upon "probable crossing points." While it is perfectly true that bridge construction is usually limited to very definite localities, the defense should not be directed at them but against attempts of the enemy to ferry troops across, and such attempts may be expected to be made almost everywhere, although they will, as a rule, threaten in the vicinity of the bridge sites. If the defender is particularly wide awake, the attacker will actually seek the difficult terrain on his side of the river in order to have a better chance of surprising the enemy and of finding him less prepared.

The companies posted at the river constitute the line of resistance. If they are to cover a front of approximately one kilometer apiece, they will have to push several supports to the bank, which in turn post outguards under non-commissioned officers in the intervals. The defense of a river requires that strong forces be posted at the river from the very beginning. One will therefore usually send entire platoons out as supports so that if two of these are sent out by a company, the third will remain to constitute the reserve. Efforts should be made under any circumstances to annihilate the first hostile echelon that attempts to cross, while it is still on the river, so that, at most, only weak fragments without any power of offensive will reach the bank on the defender's side. The support with its outguards is charged with the immediate protection of the channel and should therefore be posted directly at the water's edge at least at night. The support should be able to develop its full fire power within a few moments.

Besides, it is the duty of the outguards to prevent any and all reconnaissance. The garrison of the river bank should not allow itself to become involved in a fire action with strong hostile forces on the opposite shore, but should direct its full fire power against the enemy if he makes any attempt to cross. Active

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patrolling along the river bank will materially assist the work of the outguards at night. Hostile swimmers should not be allowed to penetrate the line.

It frequently happens that islands, separated by minor river channels, are situated in the river. It would be a grave mistake to occupy the main river bank only. The posts should always be located on the bank of the main channel and detached posts, at least, should be posted on all the islands in the river. (Fig. 26.)

All the reserves in the regimental sectors should be posted so close to the line of resistance that they can reinforce it in the shortest practicable time. But they should be able to move by

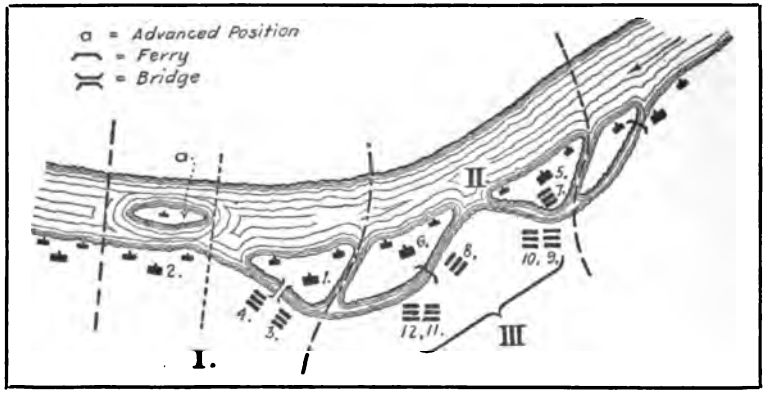

Fig. 26.
Defense of a Stream having Islands.

the flank under cover and without making detours. They should receive practice in quickly springing to arms and in promptly reinforcing the line of resistance. Whether battalion and regimental reserves should be concentrated or posted separately to facilitate their entry into action, will depend upon local conditions.

If one has not discovered the hostile preparations so clearly as to enable one to deploy parts of the reserves—at least those of the battalions and companies, at an early moment, the principal task of the reserves will consist of attacking. A vigorous offensive that will throw the enemy back across the river that he has just crossed, will best assure success. This offensive can be supported by the supports at the river, which, even at

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the risk of being cut off and captured, should endeavor to maintain their positions on the bank at all hazards, intrenching if necessary. The day will not be lost so long as the attacker can not deploy after landing, and, above all else, so long as he can not get reinforcements. The supports should, therefore, leave it to the reserves to throw back hostile forces that have crossed, and devote all their energies to the task of preventing all traffic across the stream.

There is only one case in which the reserves, during daylight at least, will be forced to act on the defensive under cover of fortifications. This will happen when the hostile bank affords commanding artillery positions close to the river, from which the entire foreground on one's own side can be so completely swept, and mayhap enfiladed, as to make all movements by reserves in the open out of the question. The reserves should then be posted in intrenched positions with the river as an obstacle in front, thereby forcing the enemy not only to cross the river under fire, but also compelling him to attack the position lying immediately behind it.—In case darkness or fog make observation of artillery fire impossible, the reserves should nevertheless assume the offensive, even in face of strong hostile artillery, against any hostile force that has succeeded in crossing the river.

One question that is again and again discussed is, whether, aside from the reserves to be launched by the higher commanders, the troops holding the line of resistance should move into an adjacent sector to assist the local garrison in repelling a hostile attempt to cross, in case they themselves are not attacked. This question can not be answered by a general statement. As a general thing, it is both right and natural for all available reserves that are positive that they will not be needed for the time being in their own sectors, to march to the support of adjacent sectors that are attacked. But the companies stationed at the stream itself must under all circumstances remain in the positions entrusted to them. If they fail to do this, hostile feints or secondary operations may lure the forces of the defender to some one point of the river while the decisive attack is, meanwhile, made against an unoccupied section of river line.

One of the principal weaknesses of the cordon system lies in the responsibility that the minor units—companies and sup-

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ports, stationed at the river have to bear. In case one such link in the chain of defense breaks, there is grave danger that the reserves, when they do come up, will no longer be able to repair the damage. Accurate instruction and careful supervision of the outposts at the river are indispensably necessary. Besides, their duties should be regulated so that night will be turned into day for all troops participating. Crossings made in the daytime will, no doubt, be betrayed by gun and rifle fire, which will wake any troops that are resting, but with supports and outpost companies that sleep at night and with a reserve that is not in instant readiness to march, a river can not be effectively defended. But it may be as well to point out that if a hostile echelon has actually managed to effect a landing, a second echelon can not follow the first until some time has elapsed. In case of a stream of 200 m. width and 2.1 m. velocity, the second echelon could be expected to arrive not less than about twenty minutes after the first. During a crossing effected at night over the middle section of the Rhine, there was an interval of forty minutes between succeeding echelons. These long intervals of time justify the hope that the reserves will be successful even against hostile troops that have managed to land, especially when it is remembered that in a regimental sector—taking as a basis the dispositions indicated in Fig. 25, over three fourths of the available troops are held in reserve.

The tasks of the cavalry naturally lie primarily on the hostile side of the river, and will be discussed in detail later on. If, giving away toward a flank, it can no longer maintain its position in touch with the enemy, it should support the infantry on its own side of the river where the stream is less densely occupied, and, in certain circumstances it may prolong the infantry line on the exposed flank. Besides these duties, it should find plenty of occupation in the very important messenger service whenever telephone service fails, and should provide protection against hostile patrols that have managed to cross and which must be prevented from destroying any of the communications.

The artillery will play a special rôle. A part of it will be held in reserve by the commander and will be posted in observation on commanding heights close to the river in order to be able to open fire promptly against hostile assembly or crossing points. Another part is placed at the disposal of the companies

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holding the line of resistance and is utilized immediately at the river bank. Here the guns are so posted, preferably by platoons, in the most advanced line of supports, as to enable them to enfilade long stretches of river and to coöperate with the infantry stationed alongside. Until the moment they open fire, the guns must be completely concealed. If this is the case, the moral effect of their fire will be great. Machine guns may be similarly used in the most advanced line.

The pioneers attached to troops defending a river course, operate the ferry and searchlight equipment, assist the infantry in constructing intrenchments, etc. Above all else, they should be looked upon as infantry that is especially trained in all that pertains to combats for the possession of river lines. If their number admits, any tasks should be assigned to them that appear to be particularly difficult in connection with the defense of the river. To this category belong particularly reconnaissance trips across the stream, which will be discussed more in detail later on. In such work their training in swimming, their ability to cross streams noiselessly with expedients of all kinds, and particularly their capacity correctly to estimate hostile measures, as well as their peace training in combats on river lines, will appear to great advantage. At any rate, the expert advice of their officers in all technical matters affecting combat for river lines, should not be disregarded, especially when it is a question of properly estimating the measures taken by the enemy.

In case not enough river boats have been found locally to suffice for patrol and ferry service, bridge trains should be assigned to the pioneers for this purpose.

Technical Means.

Technical means, especially field fortifications, serve and aid the troops stationed along the river in their work.

Even in the past "breastworks" played an important rôle in river defense, but it is an accomplishment of the present day to make field fortifications part and parcel of the defense of river lines.

As we have seen, supports stationed at the stream are required to maintain their positions without bothering whether the enemy crosses or breaks through their own line of resistance. In this way good supporting points are to be created that will make it

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more difficult for the enemy to deploy and that will make it easier for their own advancing reserves to attack. This requirement can be met only by small closed field works, which every support should construct for its own occupancy. These small supporting points should fulfill all the requirements that are laid down for closed "field works" in paragraphs 240, 368 and 369, Pioneer Field Manual. They should permit fire in all directions, particularly toward the flanks, be provided with loopholes, traverses and parados protecting the garrison as

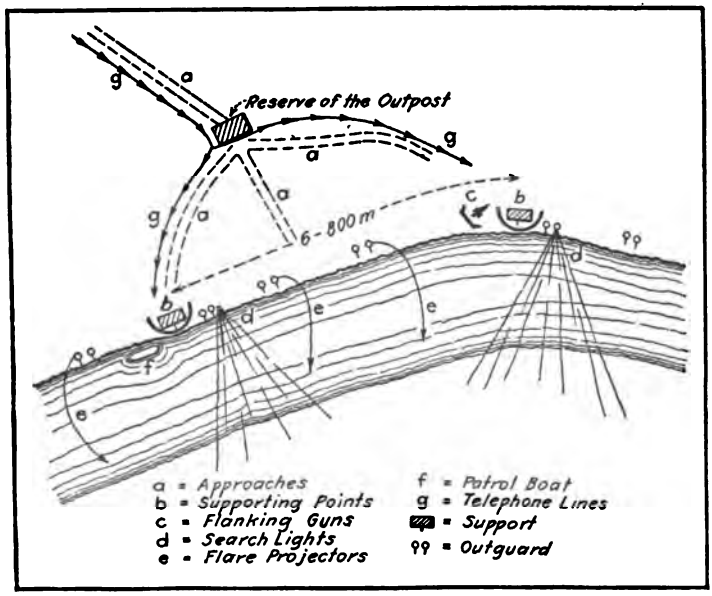

Fig. 27.
Example of a Closely Guarded River Line.

much as possible against infantry and direct artillery fire, and, above all else, be surrounded by wire entanglements as security against surprise. Concealment from the enemy's view is very valuable for them. As a protection against howitzer fire, communicating trenches running to covered terrain in rear should be provided, which will permit the work to be temporarily evacuated by parts of the support. It is left to the initiative of the garrison to make the work as comfortable as possible, for it may have to be occupied for weeks. A field of fire should

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be cleared in the direction of adjacent supports and to the rear, and good communication with the reserves should be provided. That the garrison should be plentifully supplied with ammunition goes without saying. Rations and drinking water should likewise be provided.

Rifle pits suffice for outguards stationed between the supports. These should have a good field of fire across and along the channel. Simple trenches should likewise be constructed along the river bank for the use of reserves when they come up.

All these works should be so constructed that they can be held even under artillery fire. The hardest test that they will have to stand is when, during the preparation of a forced crossing,

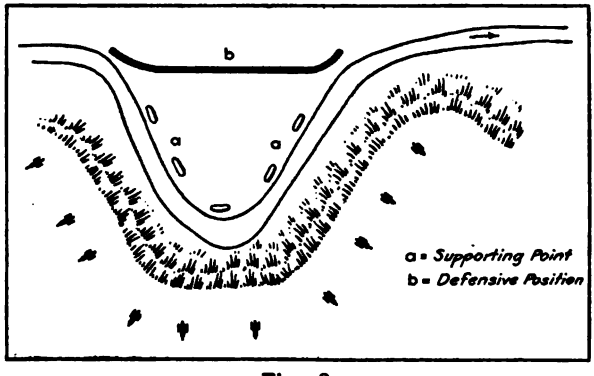

Fig. 28.

they are deluged by artillery fire, delivered from commanding heights close to the river, under cover of which fire the infantry is to cross. In case such unfavorable conditions for defense exist, very strong types of fortifications will have to be used. For this purpose, battalion groups of field intrenchments should be constructed for the reserves in the rear of the supporting points. Such group intrenchments should command the terrain between the works of the supports and, as far as practicable, the channel and the opposite bank. (For example, see Map 4.) Bends in the river that are completely enveloped by heights on the opposite shore, in other words, those that are convex toward the enemy (Fig. 28), can not be held in the face of artillery posted in commanding positions. A strongly fortified work having secure flanks, into which the reserves can be thrown,

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will then have to compensate for this weakness. In this connection, it is desired to warn against overestimating the effect of artillery fire, especially the effect of direct fire of field artillery against field fortifications. Artillery will not find it easy to shoot troops out of good cover, if they are determined to make a stubborn resistance, particularly if they can escape from the fire temporarily through good communicating trenches to the rear. The effect of artillery fire will then, likewise, be often minimized by vegetation along the river valley, as well as by dams and dikes. In addition, dummy works may divert the fire.

The artillery detailed by the defender for the immediate support of the infantry must carefully intrench on the river bank. In case it is only to enfilade the channel, it need not have any field of fire to the front, and the various guns can be protected in front by parapets as suggested in paragraph 335, Pioneer Field Manual. Machine guns may be similarly posted and protected. All these flanking emplacements should be carefully concealed from the view of the enemy, even from the view of his aviators. Overhead cover of the type mentioned in paragraphs 301 and 377, Pioneer Field Manual, is very desirable.—In case complete batteries are available, they should preferably be used in alternative positions that if requisite can be quickly strengthened by all the means available. It is characteristic of the fight for river lines that the attacker will invariably endeavor to bring far superior artillery to bear. In consequence, the inferior artillery of the defender can achieve success only in case it is not tied down to fixed positions that are easily discovered by hostile aircraft.

If the river bank is wooded, extensive abatis should be constructed between the supporting points occupied by the supports, so as to hamper the deployment of the hostile troops that may have succeeded in crossing. Abatis constructed on the hostile bank might also be of value if so located that its penetration would be discovered. Landing at specially endangered places can best be prevented by stringing wires just under the water. Anchored floating timber may be similarly used. The Danes are said to have used such timbers as well as anchored mines in front of parts of their position on the Island of Alsen.[1] It may be

[1] During an extensive Pioneer field exercise, a broad expanse of logs, loosely floating abreast of each other, was lying directly in front of a part

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especially effective to close the entrance to harbors or rivers on the hostile bank by stretching wire cable, etc., directly across the channel under the water. Such obstacles are very apt to be overlooked if the reconnaissance is not thorough.—Observation posts on the river bank and observation stations on commanding heights are just as valuable in the defense of a river line as in the defense of other positions. It has already been pointed out, in addition, that captive balloons may augment this observation.

If we add roads concealed from the enemy's view and lighted at night, for the use of the reserves, we will have completed an inventory of all the principal means that field engineering can place at the disposal of the defender of the river line.

In addition, artificial illumination will play an important part in the defense of river lines, as darkness particularly invites the attacker to make preparations for a crossing and to execute it. The simplest and best illumination is furnished by flare projectors. Unfortunately these have a range of only about 200 m. The proposition to anchor patrol boats in the river and to project the flares from them, so as to increase their range, is of little value, as the hostile troops on the opposite bank would quickly force such boats to leave. The best plan would be to equip each support and each outguard with one or two flare projectors. Unfortunately the available supply will seldom suffice for this. The only alternative is to equip patrols with them with instructions to move along the river and to fire them at various points. But progress in the field of invention may in the end furnish us with an illuminating projectile that may be fired from any rifle.

Small searchlights, which are at present being more and more generally introduced in various armies, do good service. As dams and vegetation on the river bank frequently set a limit to distant illumination of the hostile bank, the range of these lights is generally adequate. It is sufficient if their light permits hostile preparations on the opposite bank to be discovered at an early moment. Large, powerful searchlights are of value in river defense only in case they are posted on commanding heights and illuminate the channel longitudinally. Their efficacy,

of the position of the defender on the bank. The landing of the ferry pontons completely failed at this point, because the pioneers, surprised by this unexpected obstacle, could not find the means to bring the troops ashore under the hostile fire.

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in so far as the more distant foreground on the opposite side of the river is concerned, is, according to experience, not great, unless the terrain is very open.

To light large wood fires, tar barrels, etc., for the purpose of illuminating the river during hostile attempts to cross, is of very little value. As a rule, such expedients are as apt to betray the defender as the attacker.

Finally, the service of information should be as much as possible facilitated by technical means and expedients. Aside from the bicycle, the motor cycle, and the motor car, the telephone will prove indispensable and in many cases provide the only means of successfully defending a river line. Everything should be done to prevent the destruction of telephone lines either by the enemy or by natives.

When at all practicable, telephone communication should be installed between all supports and their companies, between companies and their battalions, and between battalions and their regiments. Aside from the lines that are necessary for the higher headquarters, lines connecting batteries and observation stations and captive balloons should be provided. It can be seen that in a carefully prepared river defense, a vast network of telephone lines is required, which will have to be created out of whole cloth, except in so far as permanent lines extend along the river.

To burn rockets as a signal for the advance of the reserves is a very questionable measure. Such signals are very apt to fail to function during rainy or foggy weather, may be prematurely ignited, and the enemy may give similar signals on his own bank of the river, thereby causing grave blunders to be made.

It is of the utmost importance to collect all boats on the river and in adjacent branches on the hostile bank. Though this is mentioned last, it should by no means be considered as of less importance for that reason. The best plan is either to concentrate such boats in groups at suitable points on the friendly side of the river, if they are not directly destroyed when found, or to turn them over to the outpost along the river for use in patrol work. All ferries should be seized and brought to the friendly bank of the river. They should not be prematurely destroyed. The commander-in-chief will in case of necessity decide whether existing bridges should be destroyed or should

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merely be prepared for destruction. (Par. 173, Pioneer Field Manual.)

Reconnaissances on the Hostile Bank.

We thus see the defender combine tactics and technique in order to make it as difficult as possible for the attacker to prepare his crossing and to effect a lodgment on the defender's side of the river.

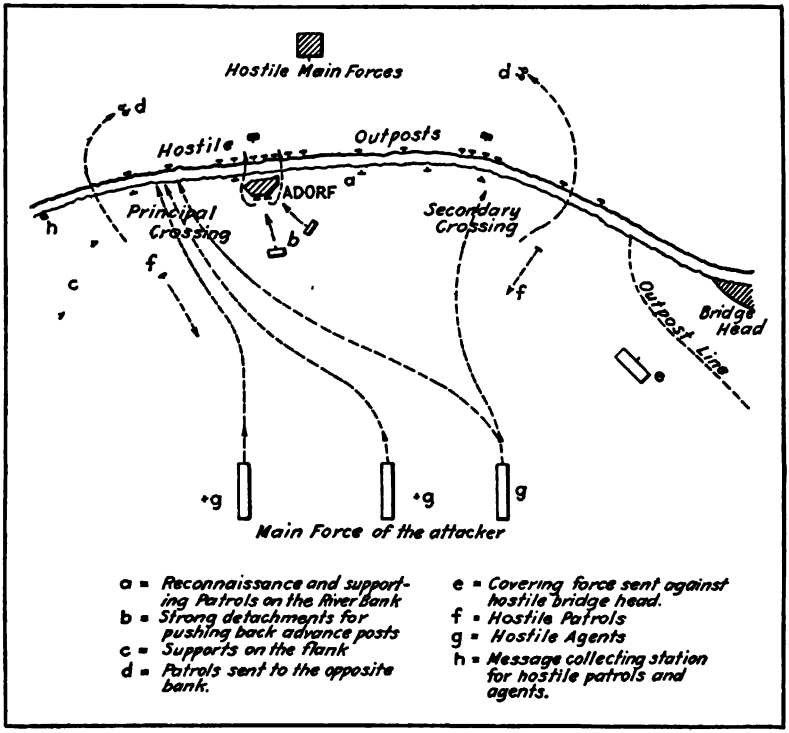

Fig. 29.

Scheme of Advancing Preparatory to Making a Surprise Crossing.

Another very effective method of preventing a crossing may be added to the ones already mentioned, viz., the reconnaissance work of the defender on the hostile bank. (See Fig. 29.)

It is perfectly obvious that reconnaissance is of the utmost importance to the defense. If by means of it, the approach and

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direction of march of hostile columns can be discovered by day, and the concentration of strong forces at certain points can be determined at night, all the secrecy of the hostile enterprise will vanish. The defender will then be enabled to dispose his troops properly, and perhaps to bombard localities where the enemy is known or presumed to be concentrating or marching, so as to meet any attempt to cross in a proper manner. This will compel the enemy to resort to a forced crossing, which does not depend upon the secrecy of the preparations, but, in face of a strongly occupied bank of a wide stream, will after all, succeed in exceptional cases only.

The reconnaissance at a distance naturally falls to the lot of the cavalry. The bulk of that arm should remain on the hostile side of the river as long as possible, endeavoring to gain information of hostile movements from a flank. It retires, when necessary, primarily over any bridges and ferries that may still be intact. In case these are lacking or in case they have been demolished, they should be replaced by ferries or boats, unless the cavalry is able to retire toward a flank on the hostile side of the river.

The reconnaissance during the defense of river lines can be materially assisted by aircraft, which are called upon to perform a special mission. In spite of all the reconnaissance work of the defender's cavalry, the attacker was nevertheless so favored in the past by the obstacle formed by the river, that he could shift his troops at will before dark after their arrival in the vicinity of the river, so as to enable them to reach the selected crossing by making a short night march. At the present time, however, he must reckon with the fact that his movements may at any moment be discovered by aircraft. This compels him to make all movements that he desires to conceal from the enemy, at night, which certainly makes the whole operation slower and more difficult.

If the reconnaissance is to work smoothly and surely both by day and at night, when aircraft are not available, it is absolutely essential that advanced posts be occupied and held on the opposite bank. The defender should, therefore, on principle occupy all supporting points located there, such as farm buildings, villages, patches of timber, etc., and should not evacuate them—as in the case of advanced posts of fortified field positions,

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until the enemy forces him to do so. (For example, see Map 3.) It may be particularly effective to delay the enemy with small detachments posted in passes of the mountain ranges that frequently parallel the streams. Such passes can easily be obstructed and prepared for defense. Whether it will be feasible to push stationary patrols across the stream between the supporting points and thereby prevent the enemy from gaining any information whatever except by fighting, will depend upon the amount of ferry material available.

The value of such advance posts—which should, by the way, not consist of more than half a platoon or a platoon of infantry and a few troopers, is very great, as they can spoil the attacker's whole plan. As point of departure and support of the defender's patrols and scouts, they are an ever present danger for all hostile reconnoitering parties, whose activity they will curtail in a very undesirable manner. The attacker will have to force them back across the stream before he can begin extensive reconnaissance and before he can have any assurance that all the measures he takes will not be continually spied upon. To this end, he will have to push comparatively strong forces to the river at the very beginning of his enterprise, and these may become involved in many a disadvantageous and protracted village fight. In fine, everywhere he turns, he is faced and hampered for the time being by these advanced detachments of the defender.

Besides, there is no better expedient than such advanced posts for quickly discovering an envelopment of one's flanks or an advance against weakly occupied sections of the river. If the advanced detachments in any locality are not disturbed at all for any length of time by the enemy, one will be secure from a hostile enterprise there. In case they are pressed back, increased vigilance will be necessary. Detachments posted on a flank are always an excellent point of departure for patrols despatched against a flank of the enemy and, likewise, serve as a support for strong cavalry detachments that have remained on the hostile side of the river.

The advanced detachments should retire when the enemy forces them to do so. Their small size and the chance, which often exists, to support them by fire from the other bank, are an advantage, their frequently inadequate communications across the stream, a disadvantage. For the latter, an advanced detach-

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ment must depend principally upon bridges and ferries. These should, therefore, be kept intact so long as one can count with assurance upon there being ample time for destroying them or for rendering them useless. In case such crossings are not available, or in case they have been demolished, boats should be kept in readiness for the use of the advanced detachments. Even simple life rafts (timbers, boards, etc., see Appendix I), which dispersed troops can use to make their escape to their own side of the river, may be of value.

As desirable as it may seem to reinforce an advance post pushed across the stream, in order to increase its power of resistance, or to enable it to assume the offensive on occasion, it should be remembered that in the absence of bridges and capacious ferries, detachments of some size will in most cases not be able to re-cross the stream. They are very apt to be annihilated or captured by the enemy.

Such detachments act as supports and message collecting stations for outguards, patrols, and scouts sent out by them. But they should be able to reach the friendly bank of the river anywhere along the stream by swimming at a pinch. The men detailed for this duty should be selected and equipped with this end in view. That pioneers, thanks to their peace training, are especially suited for such reconnaissance work has already been mentioned.—The method of reconnaissance—also that effected by scouts, and the means available for transmitting information, will not be discussed. It suffices if patrols indicate the presence of strong hostile bodies or of bridge equipment, by clearly visible signs or signals. Telephone communication with the advance posts on the opposite bank is indispensable.

Finally, it is perhaps to be expected that all the advance posts will be driven away from the opposite bank and that the defender will have to depend upon the resistance rendered by the troops on his own bank. But even in that case, special value should be attached to reconnaissance across the stream.

Patrol boats will be very effective in this work, but will not be able to operate unless the enemy is anything but vigilant. One will not be able to count on anything with certainty except upon patrols that cross the stream by swimming. Their task may be considerably facilitated if they are equipped with portable life-preservers. One will not, in general, be able to assign

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them extended tasks, but frequently it suffices, after all, to determine whether the preparations that one believes are being made in view of other information, are actually in progress on the hostile river bank. A single, lucky patrol can tear asunder the veil that shrouds the hostile enterprise in secrecy.

Unarmored motor boats will, no doubt, be of value only on streams a mile or more wide and on lakes. On narrower streams any cavalry patrol would be able to interrupt their operation by its fire. Besides, the proper field for reconnaissance work is, after all, not on the channel itself, but on the hostile bank.

Demolition of Bridges by Floating Objects.

Another expedient of use in any river defense, consists of measures for destroying completed hostile ponton bridges. Heavily loaded boats, rafts, and trees floated down stream may become exceedingly dangerous to a ponton bridge—which is, after all, a very frail structure, especially if they strike it at night. But such objects must be launched in a mass against the bridge. They can be secured before they can do any damage, only when an extensive and well-prepared river guard service is established, which, in time of peace, frequently breaks down and in time of war, will, therefore, in all likelihood, also be neglected at first. To be sure, such an expedient will be used only in the case of very wide and swift streams, but it is in their case particularly that great damage may be done thereby.[1]

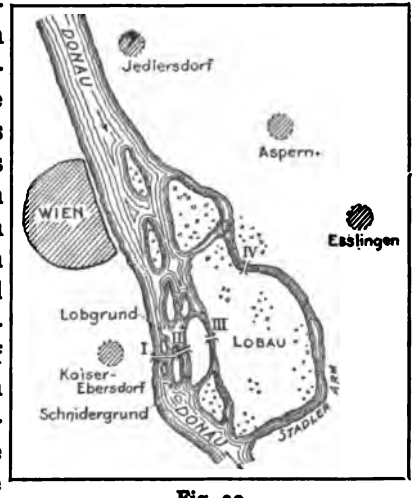

Fig. 30.

[1] That the bridges over the Danube were destroyed by floating objects during the battle of Aspern, is well known (Fig. 30). On May 19 and 20, 1809, Napoleon threw four bridges over the arms of the Danube south of Vienna, with the intention of using them for moving his army against the Austrians posted on the left bank of the Danube. From the morning of the 20th on, the Austrians launched mills and rafts against these bridges from Jedlersdorf, which so damaged bridge II, on the evening of the 20th, that it could not be

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Fortresses located on the stream are particularly suitable points from which to set such floating objects adrift. Any detachment that has not as yet been driven away by the enemy, can do this, however, but care should be taken to have the requisite boats, etc., in readiness in time. Floating mines are difficult to construct and the known types are not very reliable. Their construction is the business of the pioneers.

II. DEFENSE OF A RIVER LINE WITH SMALL DETACHMENTS POSTED ON THE BANK.

General.

The problem of holding a river line for some time with weak forces arises with great frequency in war. It may require a solution primarily by means of the purely passive defensive, such as is exemplified in the cordon system. But this will have to be decided in every case in which time must be gained to allow reinforcements to come up, to permit the main forces to continue their retreat, to enable separated parts of the army to effect a junction, to allow positions to be fortified, etc. The problem may primarily involve an occupation of the river line for a time for the purpose of barring the advance of strong hostile forces that might interrupt the operations that friendly main forces contemplate making or are actually making against other hostile troops. (See Fig. 31.) All these cases require merely that the enemy be repelled at the river by small detachments, in other words, a task such as is usually allotted to an advance or rear guard, or other advanced troops in field operations.

used again until the morning of the 22d. This mishap materially delayed the French advance. On the afternoon of the 21st, the bridge was broken a second time, and the French did not succeed in repairing it until the night of the 22d. The crossing of three French corps now proceeded rapidly. Then bridges I, II and III were again torn by rafts that the Austrians had steered to within 1,500 paces of them. The repair work lasted until 3 P.M. Finally, they were again so thoroughly demolished about 6 P.M., that their reconstruction was not completed until the 25th. Without an adequate force on the left bank of the Danube and without a means of retreat, Napoleon was forced to give up the fight and to withdraw to the Island of Lobau.

The destruction of the bridges was accomplished in spite of the fact that the French had rammed a line of piles across the stream, 500 m. above the bridges, and had a large number of well equipped boats available for guarding the channel. (See "Schutz und Zerstörung von Kriegsbrücken," by Captain Calsow, in "Mitteilungen über Pionierwesen," 1911, p. 113, et seq.)

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Every commander knows that covering forces, whether they are advance, flank, or rear guards, or outposts, can not offer a decisive and permanent resistance, but they are at least to keep the enemy at a distance for a while, to force him to make protracted preparations, to compel him to make turning movements, and, on occasion, if he advances incautiously, to give him a severe drubbing.

A number of tasks for small covering forces have thus been enumerated. The most important, however, remains to be

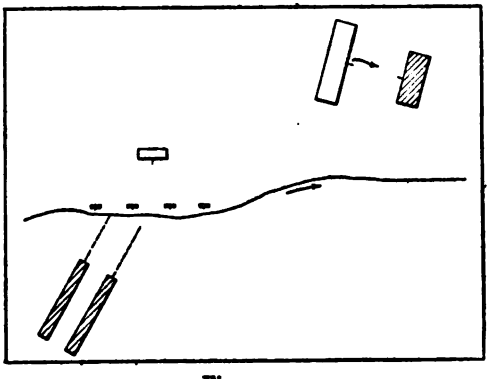

Fig. 31.
Warding Off Approaching Hostile Reinforcements.

added, viz., effectively to prepare the offensive of their own main force against the enemy, as he is in the act of crossing the river. Whereas all the other cases involved only gaining of time, mere warding off, and no decision, this case requires that the advanced force delay the hostile crossing only long enough to allow its own main body to come up in time to strike the enemy while he is in the act of crossing, not for the purpose of merely repelling him, but of defeating him decisively. The original defensive in rear of the river is coupled with the offensive in this case, and really imparts to it all the decisive value it has. The attacker fears this offensive carried out by retained forces, and, for that reason, seeks to cut down the time consumed in crossing, endeavors to throw a number of bridges across the stream, does not mind making extended turning movements, and attempts by means of feints to induce the hostile main forces to move in a wrong direction. It is obvious that small covering detachments

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posted at the river, are charged with exceedingly important missions. If they succeed in performing them in such a manner that their main forces can strike in time and effectively, the enemy may suffer a serious defeat, a much more valuable result than the purely passive defense of the cordon system could possibly attain.

The weakness of the troops stationed directly along the stream, is characteristic of the river defense here discussed, whether that defense involves merely delaying the enemy in order that time may be gained, or making preparations for the offensive of strong forces held in reserve in rear. Their weakness may be due either to the fact that not enough troops are available for this work, or to the fact that one does not wish to employ more troops for the purpose because of the fear that that might seriously deplete the main force. The defense of the river bank, which, in the cordon system, was entrusted to comparatively strong bodies under especially favorable conditions, must in this case be left to small detachments. The delay, which in the former case was almost a certain result of the measures taken, depends in the latter frequently upon blunders made by the enemy and upon chance, which may, indeed, be very largely superinduced by foresight, initiative, and energy on the part of the defender.

For this, if for no other reason, this method of river defense is intensely interesting and requires that the personnel possess qualities of a high order, but, on the other hand, gives even small bodies greater chances to achieve success than almost any other operation. A single well posted battalion that is efficiently handled at the golden moment, may cause the crossing of a whole army corps to fail. A German army corps has 38 pontons with accompanying equipment available—aside from the collapsible boats carried by the cavalry regiments, and this is the only matériel that need be considered for the present. If the corps, perhaps hampered by the terrain and lured on by the apparent inactivity and inadequacy of the hostile river guard, proceeds incautiously, which is, in reality, characteristic of rapid, forced crossings, a numerically weak but well handled skirmish line stationed opposite the crossing point, may actually dispose of these 38 defenseless vessels, crowded with men, as they approach the hostile bank. By this act, however, the corps

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will have been quickly and thoroughly deprived, for the present, of the wherewithal to cross the river, and it will usually take a good deal of time before fresh bridge equipage can be brought up and the operation repeated with greater circumspection. Thus, small units of the defender may gain extraordinary success, but foresight, energy and deception of the enemy will invariably be the preliminary conditions upon which such success is predicated. It is proposed to emphasize these preliminary conditions again and again in discussing the details of this method of river defense.

Defense of Wide Streams.

The defense of an unfordable stream that on account of its width and volume of water alone constitutes a considerable obstacle will be discussed first. Let us assume that such a stream has a minimum width of 70 or 80 m. Posted with such an obstacle in its front, a small advanced detachment will still be able to repulse the enemy and to cause his crossing enterprise to fail, or at any rate, gain enough time to enable strong forces to come up, which, by attacking vigorously, can complete the only partially successful repulse of the enemy.

Preliminary Defense of the River Line.

Under the conditions given, it will, in the first place, be necessary to get some covering detachments to the river and to move them quickly into their assigned positions. During retrograde movements, especially, the troops, which may have but few points available for crossing the stream, must quickly deploy on its opposite bank in order to bar the enemy's way to the best crossing points in time and to occupy them. The problem of quickly barring the enemy's advance at a river line during a retreat will, therefore, be discussed first. The appropriate measures to be taken in case the force is in motion or at a halt, can be easily deduced.

The commander will be obliged to withdraw a part of his cavalry from the front, no matter how undesirable this course may seem to him during a retreat, and have it occupy the crossings temporarily but quickly. (Fig. 32.) The existing conditions will determine whether the cavalry should cross the stream on

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a broad front by bridges, ferries, or by swimming, and this is the preferable course, or whether it should follow the general line of retreat, cross the river and then spread out toward the flanks. But, in any event, the river must be guarded along a broad front, for if the enemy anticipates that his crossing will meet with considerable difficulties, he will, in all likelihood, start wide turning movements at an early moment for the purpose of crossing the river outside the zone of the hostile defense. The pursuer's cavalry will, in the first place, sweep around on a wide arc and endeavor to cross the river. Its presence on the defender's side of the river where it may cut communications, gain informa-

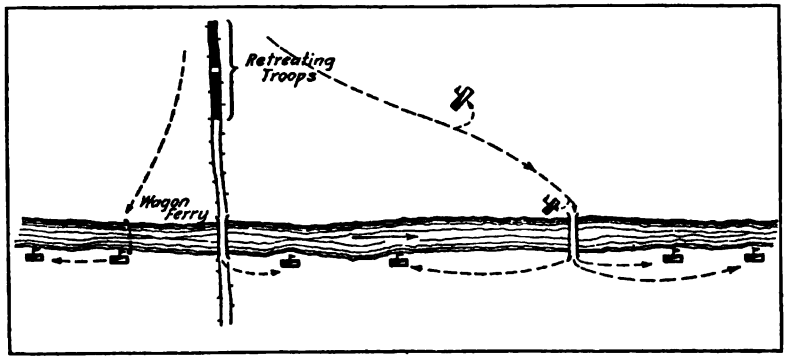

Fig. 32.
Preliminary Defense of a River by Cavalry.

tion of the strength of the troops guarding the river line, and from a flank assist the crossing of other troops, is, of course, highly undesirable for the defender.

To ward off such turning movements, is naturally exceedingly difficult, if not impossible. Fast power boats equipped with machine guns and searchlights may assist the defender's cavalry in repelling such movements. In addition, the defender's cavalry sent out to cover the crossings, should endeavor to exert as much influence as possible on the hostile measures and gain time for its own troops. This it may do by having the units on its flanks extend over a very broad front, even if this is accomplished merely by posting stationary videttes with instructions to show themselves so as to make hostile reconnoitering patrols believe that the river line is held in force and to induce them to

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make wider and wider turning movements. If the defender has larger bodies of cavalry available, they should be used on the extreme flanks, preferably on the hostile bank of the river.

Upon arrival at its assigned position at the river, the cavalry should first regain contact with the enemy, if that should have been lost—a subject that we shall revert to again. Secondly, it should barricade, prepare for demolition or destroy all bridges and ferries and collect or render useless all boats on which it can lay its hands. The last mentioned measures are of such extreme importance that the order of the commander-in-chief should specifically direct attention to them and should indicate the extent to which barricading or demolition is to be carried. If operating in friendly territory, as yet but slightly touched by the war, the commander will be able to send telegraphic orders to all communities within the area of operations along the river, directing them to barricade bridges temporarily, to withdraw all ferries and to collect all boats, thereby anticipating the work of the cavalry. The cavalry may be reinforced by cyclist detachments and, in addition, pioneers may be attached to it in case extensive demolitions have to be undertaken.

In most cases it will be necessary to use infantry to replace the cavalry that was sent to the rear to cover the crossings.

Although an accurate scrutiny of the map may have been impossible before posting the cavalry along the river, this should not be neglected in making the dispositions of the infantry. It may, occasionally, also be advisable to supplement the information gained from the map by timely local reconnaissance, for which work pioneer officers and the commanders of the various detachments that are to be pushed to the river, are preeminently suited.

A consideration of the general tactical situation, the direction of the enemy's advance, the lay of the roads, and the character of the terrain on both banks will indicate—as explained in the chapter on "River Crossings," definite points that particularly invite a crossing and which the enemy will, in all probability, give the preference for his enterprises. Strong infantry detachments should, in the first place, be posted opposite such points. In the crossing in the Mayence theater of operations—heretofore discussed, such points would be those on the right bank of the Rhine opposite Nierstein-Oppenheim, opposite Rhein-Dürk-

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heim, and perhaps opposite Gernsheim also. (See Map 1.) It would be desirable to have one battalion with a little cavalry at each one of these points, for a battalion is quite strong enough, if skilfully handled, to oppose the crossing of even a strong body of troops with some prospects of success. In addition, a strong cavalry force should be posted on the exposed flank, in the direction of Rhein-Dürkheimer Fahrt, if practicable on the left bank of the Rhine.

These infantry units—under the assumption already made, one battalion for each crossing, should be distributed among the most important crossings and should, if practicable, arrive at their posts before nightfall. Upon arrival, they are assigned to adjacent, often very wide sectors and must defend these inde-

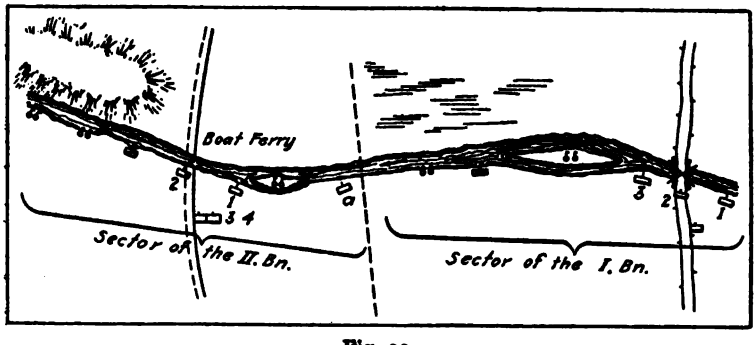

Fig. 33.

pendently. (See Fig. 33.) The less important sections that lie between the positions of these battalions are not occupied but should be closely watched, an active patrol service being maintained for this purpose. If these unoccupied sections are too extensive, it may be advisable, in certain circumstances, to post single companies there, which can be placed under the orders of the commander of the nearest adjacent battalion. Thus, in our example, it might have been a good plan to push a company forward to "F" Knoblauchsaue. But in the main, communication between the battalions should be kept up by the cavalry, which, after it has been relieved by the infantry, can usually be spared at its former posts to the extent that it is employed in reconnoitering across the river.

It is particularly important to conceal the strength of these

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detachments from the enemy. It may be desirable to appear stronger at some points than one actually is, in order to keep the enemy from attempting a crossing. This is the case in the wide intervals between the positions occupied by strong bodies of infantry and on the flanks. Any detachments posted there should, therefore, be instructed to show themselves unobtrusively, but nevertheless diligently and to make it appear that they are stronger than they really are.

But if the strong forces concentrated at the most important crossings are to be successful, they will have to conceal their presence and their strength from the approaching enemy as much as possible.[1] He must be induced to display carelessness, that is to say, betray his contemplated crossing point, or deliberately choose a method of crossing that is practicable only in case the hostile bank is weakly occupied, such for example, as attempting a crossing without sufficient artillery and infantry support. As already stated, an initial success may suffice to make the whole hostile operation fail. The defender should use his utmost endeavor to bring this about and to overwheim the enemy with a strong and sudden burst of fire the moment he makes a careless attempt to cross. It may even be said that the defender should deliberately lure the attacker to the points where he wants him in order to give him a warm reception with troops that have previously been kept under cover.

When opposed by a carefully advancing attacker, the difficulties of a weak defender are naturally increased so materially that there is practically no hope of overcoming them. These difficulties arise when the attacker throws troops across on a very wide front, either by day or at night, uses his artillery effectively to support the operation, and selects crossing points that the defender did not expect him to use. Aside from an advance by retained forces and considering only the resistance to be rendered by the troops posted at the river, mobility is the only defense against this. At least parts of these retained troops, cavalry, for example, should be quickly thrown to the threatened points. This mobility may be increased by requisitioned wagons, bicycles, and, in the vicinity of large cities,

[1] Outguards should not fire at every hostile reconnaissance patrol that shows itself, nor, what is worse, engage in a fire fight with hostile bodies that appear on the opposite bank. If hostile patrols cross the river to reconnoiter, it will usually be a good plan to capture them as quietly as possible.

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motor cars. But it is absolutely essential that troops stationed on the flanks report promptly any information they may have gained in regard to a hostile attempt to cross.

The line that the infantry should occupy for warding off a hostile crossing, lies on the river bank itself. The defender should be able to develop strong forces there quickly. Supports and outguards should be posted directly on the bank—as in the cordon system, ready for action, but during the daytime may be withdrawn into nearby positions from which the whole channel is visible. The line of resistance will generally be so weakly occupied as to make it necessary to reinforce it with other tactical units. A front of more than 500 m. can scarcely be assigned to

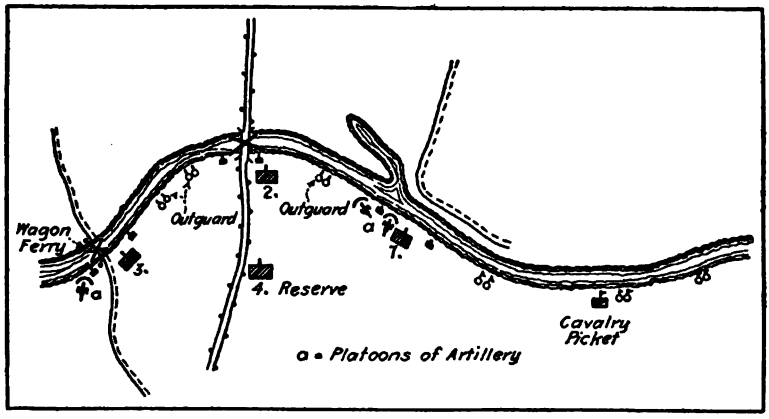

Fig. 34.
Distribution of a Battalion.

a company, but it is by no means essential that the closely held sectors of adjacent companies be in touch. The companies should be posted solely with a view to making strong bodies of troops available promptly opposite the points at which the enemy will probably throw troops across. The less threatened gaps between the companies should be closed by posting outguards in them. (See Fig. 34.)

Although the battalion reserve, which should, if practicable, always be provided, will be close in rear and can hurry to the assistance of troops at specially endangered points, each company will, in general, be thrown upon its own resources after all

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and will have to endeavor unaided to repel any attempt to cross. This requires that good judgment be displayed in selecting its position. The map should, therefore, be thoroughly scrutinized to ascertain what roads are available for the enemy's advance, and whether there are any harbors, river arms, and islands on the hostile side of the river. In addition, a personal reconnaissance should be made to determine the conditions affecting the hostile advance on the opposite bank. If proper attention is paid to these matters in posting the companies, apparent hostile advantages, such as embarkation points in harbors, in river arms, or behind islands, may actually be converted into disadvantages.

It is very desirable to attach experienced pioneer officers to the detachments pushed forward to the stream. It is the duty of these officers to assist subordinate leaders with their advice. Pioneers will, likewise, be able to render valuable service. The method of their employment, especially in so far as reconnaissances on the hostile bank are concerned, has already been discussed.

In exceptional cases, artillery may be attached to these advanced detachments. It should be employed by platoons—as in the case of the cordon system, posted in suitable positions from which the channel can be swept longitudinally. (See Fig. 34 at *a*.) Guns posted opposite harbors and opposite the mouths of tributaries, will be especially effective in case the enemy attempts to cross. Machine guns should be employed in a corresponding manner. Occasionally, guns may be used with advantage to direct bursts of fire against hostile concentration points or against defiles that the enemy's columns, especially his bridge trains, must use in order to reach the river.

Reconnaissance of Hostile Movements and Measures.

The chances of success would be small indeed for the defender's troops posted along the river, were it not for the fact that they are assisted by a measure that played a decisive rôle in the cordon system, likewise, viz., the reconnaissance made by patrols and scouts to ascertain the enemy's movements and measures on the opposite bank. Whether or not a river line can be held with small detachments for some time, will depend, after all, primarily upon the success of the reconnaissance.

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If it can be definitely established where the enemy expects to cross, the defender's chances of succeeding will be materially increased.

All that was said in regard to reconnaissance in connection with the cordon system, applies here likewise. It may be that the chances of the reconnaissance will be especially favorable in the case under consideration, because the narrowness of the stream facilitates the despatch of patrols and information across the channel and because the enemy is naturally apt to advance less carefully and deliberately against a river line that he soon finds is but weakly guarded, than against one that is held in force. The use of patrol boats is most urgently to be recommended.

It does not appear desirable to push detachments of some size (platoons) across the stream as supports for patrols where the friendly bank is occupied in force. To do this would only result in betraying the defender's dispositions and rob him of one of his principal means of achieving success, that of surprising the enemy who expects to attempt a crossing without making adequate preparations. But it is indispensable to send stationary patrols to the opposite bank unobtrusively, preferably by swimming, at as many points as possible at nightfall, in order to get timely notice of the arrival of strong hostile forces. According to experience, the attacker will frequently neglect to occupy the river bank except at the points where he intends to cross and men swimming across can easily land at such unoccupied sections, provide themselves with clothing previously hidden and then proceed with their reconnaissance. After the first troops that are to be thrown across have arrived, hours will usually pass before the crossing actually begins, and, consequently, there will be ample time for these patrols to transmit reports across the stream either by messengers swimming across or by flash signals. The information gathered in this reconnaissance is of such vital importance that it should be a point of honor with every company and every isolated support, to know at any moment definitely whether and where preparations for a crossing are in progress within the sector entrusted to their care.

Wherever the defender has nothing to conceal and where, on the contrary, he desires to deceive the attacker as to his strength, it is especially advantageous to hold supporting points on the opposite bank, particularly on the flanks.

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In the Mayence theater of operations (see Map 1), for example, Nierstein, Oppenheim, a point northeast of Eich, and a point opposite Gernsheim, should be occupied during the night by patrols only, whereas Hamm, Ibersheim, Rhein-Dürkheim, and Rhein-Dürkheimer Fahrt should be occupied more strongly, depending upon the number of troops available.

It still needs to be pointed out that here, likewise, aircraft may gain valuable information as to the intentions of the enemy, and, therefore, if at all practicable, such craft should be attached to the covering troops stationed at the river.

Employment of the Reserves of the Line of Resistance.

The conduct of the troops occupying the river bank in the event that the enemy has already made a lodgment on the defender's side, deserves special mention. If the enemy succeeds in bringing over reinforcements, all chance of the troops on the river bank successfully defending it, will have vanished. Everything, therefore, depends upon throwing the hostile troops that land first, back across the river. This requires that all parts of the defender's force that can be made available for the purpose, assume the offensive. This applies, in the first place, to the battalion reserves, which must be stationed close to the line of resistance in readiness to march at a moment's notice. To what extent the troops at other parts of the line of resistance will participate, in case they have not been molested by the enemy, will depend upon their estimate of the situation. If they anticipate that the enemy will immediately attempt a crossing in their front, they should not leave their positions. If, on the other hand, they do not consider themselves threatened, their offensive against the enemy who has crossed in an adjacent sector, will be the best solution of the problem, in fact the only one that may still spell success. It is only by vigorously attacking from all sides, by making the most of accidents and chance, that the small detachments holding the line of resistance can still hope to wrest success from the enemy once he has crossed. If this attack fails, the enemy will bring over more and more reinforcements, will make a lodgment in the natural supporting points along the bank he has gained, and will then, before advancing further, wait until the bridge in his rear is completed or until adequate forces have been ferried across. The de-

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fender's bank of the river will then be wholly lost and in the hands of the enemy. Even at best, the defender will have accomplished nothing but to delay the hostile crossing. This delay may suffice to allow the retained main forces to come up, or he may, at least, be able to report where the enemy is crossing, which may, perhaps, be of decisive importance. In addition, he can improve the situation so far as his main forces are concerned, by continuing to hold a few supporting points in the foreground along the river. These will retard the advance of the enemy, deprive him of elbow room for his deployment, and thereby facilitate the offensive of the defender's main forces.

Main Forces.

The main forces should be so posted in the vicinity of good communications as to enable them to reach any point promptly where a hostile crossing occurs. The location of probable crossing points will exercise considerable influence on their position. If according to the general situation, a crossing during the last hours of the night is to be anticipated, the reserves will have to be alarmed and in readiness to march from their assembly points.—It is especially important to conceal the position of the main forces from the enemy. In order to conceal them from hostile aëroplanes, they should be billeted in villages or posted in woods. Bivouac fires should not be lighted at night. When the danger is great, it may be advisable not to post the main forces concentrated, but in groups with easy communication between them.—The task of the leader is very difficult in that on the one hand he must not allow himself to be lured in the wrong direction by feints, and, on the other, must not delay his advance so long as to miss the proper moment for action. In order that he may at all times be well informed of the situation at the river, information officers should be sent to all detachments stationed there. The danger of the commander being deceived will be reduced if he possesses a thorough knowledge of how an attack against a river line is conducted, uses his aëroplanes by day and his swimmers and boat patrols at night, maintains close touch with the troops guarding the river bank, and does not get excited and assumes that any reported attempt to cross is serious, if only a few boats are employed in it.

But even if he is deceived, all is not lost as yet, for he need

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consider only an attack against the hostile troops that have managed to cross at a single point. For some time he will still have a good opportunity to act, unless he loses his head and gives everything up as lost. Energy and boldness that shy at nothing, are more necessary in this than anywhere else." [1]

The defender's main forces will assume the defensive only in case they can occupy a position that the enemy will have to attack after he has effected a crossing (Wartenburg), and that is so strong that considerable difficulties will be encountered in its capture. But if the defender's main forces can not, in such a case, assume the offensive themselves at an early moment, there will be danger that after they have become completely engaged, they will not be able to ward off other attempts to cross elsewhere, and that they will be turned and thrown out of their position by a flank attack. The defense of the river line will then have ended in failure, unless the time gained is claimed as a success.

Use of Technical Means.

Field works do not have the same importance for weak forces defending a river line as for troops in cordon formation. To use them extensively would be inconsistent with the intention of concealing the presence of strong forces from the enemy, and with the necessity of occupying and defending alternative positions and, when requisite, of assuming the offensive. In exceptional cases only will it be proper for the defender to occupy supporting points (buildings, for example), and to repel the crossing from them. Hence, neither small field works, like those recommended for the cordon system, nor any other expedients such as visible wire entanglements, abatis, etc., that would apprise the enemy of the fact that the opposite bank is held in force, should be used. They would only serve to make the attacker more cautious and, above all else, cause him to throw troops across elsewhere, against which move the defender would be almost powerless on account of his numerical weakness. It will usually suffice to have the skirmishers find cover behind natural features, such as the river bank with its dam and vegetation frequently affords, and to provide merely head cover and concealment from view. When this is done,

[1] See Balk, "Taktik," VI, p. 208.

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they will be able to bear even the superior rifle fire of hostile troops that usually support the crossing from the opposite bank. Artillery fire will constitute the only real danger and may even become unbearable if it comes from commanding positions and mayhap enfilades the defender's troops concealed along the river. In such a case, good cover along the river can not be dispensed with, but should not consist of connected infantry trenches, but rather of closed rifle pits, whose evacuation the hostile artillery, even if it is far superior, might find it very difficult to effect, especially if it has nothing but guns. The defender will have to exercise special care in locating and masking all the cover constructed so as to conceal it from the enemy's view. Dummy works may be of value at places where one does not desire the enemy to cross. Natural observation stations located anywhere along the river should be utilized.—It may likewise be desirable to reinforce supporting points located in rear so that there may be some assurance of holding them after the enemy has effected a crossing, until the defender's own main forces arrive on the scene.

It is exceedingly important that the roads be repaired. They should be so located as to enable the reserves to reach any point along the river line unobserved, if practicable, and should also enable the troops at the river to move by the flank. If necessary, the roads must be screened from observation by masks, marked and at night illuminated.—Any bridges over tributaries of the river must be prepared for demolition, unless they are of no use to the defender, when they may be destroyed at once.

The transmission of information is of special importance, as in the cordon system. Above all else, two separate and distinct telephone lines should, if practicable, be laid to the retained main forces in rear, and mounted messengers, cyclists, and, in certain circumstances, motor cars should be held in readiness in order that reliable communication may be available to the rear under all conditions. Moreover, every company pushed forward to the river must be connected by telephone with its battalion commander, and, as far as practicable, also with its outguards. Observation stations should likewise be connected up. Visual signals may replace the telephone when the latter is not available.

Illuminating equipment should be sparingly used. If used prematurely, it will betray the presence of the defender and will

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only cause the attacker to support his crossing with more artillery and infantry, or to shift his crossing points at the last moment to inadequately guarded terrain. It is, moreover, usually impossible to illuminate anything but the channel itself, and the preparations in progress in rear of the cover on the opposite bank, will be visible in exceptional cases only. The illuminating contrivances had better not be used until the sound of the launching of the hostile pontons and of the commencement of the ferrying can be distinctly heard. If the defender then succeeds in clearly illuminating the crossing point with searchlights and a lively fire from flare projectors, this unexpected development may have a considerable moral effect in addition. Illuminating equipment should not be used prematurely except at points where one desires to deceive the enemy as to one's strength.

Strong and Weak Detachments for River Defense.

So far we have assumed that about one battalion was posted at each of the points where resistance was to be offered. If, in an exceptional case, a stronger force has been detailed for this, and has to defend an especially endangered front independently, the chances of success in such a locality will naturally be increased, as more extensive deployment can be effected and as stronger reserves can be held out. The method of river defense will then approximate the cordon system more closely. Whether this will result in better protection of the whole river line considered, will depend upon whether the terrain adjacent to the strongly occupied sector is or is not suited for a hostile crossing.

The problem of repelling an attempt to cross is far more difficult in case only very weak forces are available for guarding extensive reaches of river.

Such weak forces will, as a matter of fact, be able to achieve success only in case they take position in bodies of some size, say battalions, in the vicinity of the river where the situation and the lay of the ground make a hostile crossing probable, and if they push nothing but small posts forward to the river. These formed bodies should endeavor to deploy promptly on the river bank in case they discover an attempt to cross or assume the offensive against hostile troops that have effected a crossing. If they are to succeed, it is indispensably necessary that they

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possess great mobility, obtain reliable information (primarily by aircraft) of the enemy's advance, and that the enemy display great carelessness in the preparation as well as in the execution of his crossing. If an adequate number of motor cars is held in readiness, the larger cities in the vicinity being drawn upon, if necessary, the prompt transfer of infantry to any threatened point can be effected with ease.

Such an employment of strong units will be especially successful against cavalry that crosses without adequate infantry support, even if the operation has already begun, as quite naturally, its progress is slow owing to the limited amount of bridge equipage carried by the cavalry.

Finally, the troops pushed forward to the stream may be limited to a few companies, platoons, or even strong patrols. These are despatched, frequently at random, to points where hostile enterprises are anticipated. But the moment the enemy discovers how weakly the river is occupied, he will make short shrift of the defender's troops and will either force a crossing with his artillery and infantry, or evade the defender's position entirely and cross quickly elsewhere. Such weak forces will be able to repel the enemy successfully, only in case they have managed to conceal their presence completely from the enemy, and the latter is on that account especially careless in his attempt to cross. Here again, the cavalry with its meagre bridge equipment will be most apt to suffer.

On occasion, however, showing all the available forces, lively fire, careful watch of the channel, and its illumination at night, may deceive the enemy as to the strength of the defender. The attacker will hesitate, his advance will be delayed and, better still, time will be gained for the defender's main forces, which have previously been held in readiness, to come up.

The advanced detachments may be made numerically very weak, if they are merely to send information back punctually, but they should always be plentifully supplied with all that is necessary for transmttiing information.

Defense of Narrow Streams.

It will be impossible to check the hostile advance at a narrow stream, and well-nigh impossible to delay it perceptibly. None but a faint-hearted attacker will allow himself to be deceived

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by expedients like those just described. The strong bridge trains which accompany all armies nowadays, and which are, as a matter of course, invariably attached to the leading subdivisions when a stream is approached, make it possible to build reliable bridges quickly anywhere.[1] Stubborn resistance may, indeed, make the crossing more difficult at some points and may cause the attacker losses, but will surely break down the moment a superior hostile force advances on a flank over an unoccupied part of the stream, a move for which the service bridge equipage, hasty bridges, fords and intact permanent bridges, will frequently afford ample opportunity.

To push strong detachments forward, or to leave them behind to defend a narrow stream, may, without question, be considered an improper move, for this will always involve the defense either of an advanced position or of a rear guard position, with all their inherent disadvantages. Troops defending such positions on narrow streams will be especially endangered, since they can not, as a rule, carry out their mission properly if they retire as soon as the enemy gets within close range, but must wait until he appears directly in their front at the stream and begins to cross. They will scarcely be able to effect their retreat without appreciable losses, unless they do not occupy the bank directly but take up a position on the bluffs that command the river valley. Such narrow streams should, therefore, be defended preferably by the cavalry. Cyclists, weak patrols, and occasionally detachments transported on wagons may be utilized in such defense. Protection of the flanks is particularly desirable. It is, moreover, advisable to hold the river line so that not only frontal but flanking fire as well can be brought to bear on the channel.

One will, therefore, frequently desist from defending narrow streams with advanced detachments unless such defense involves merely screening and temporary delay, or in case one expects to gain timely information as to where the enemy will cross. If the defender's troops succeed in delaying this crossing even for a very short time only, the attack of his main forces may perhaps have a very good chance of succeeding in case the enemy is hampered in his movements not so much by the

[1] In case troops have lost their bridge trains after disastrous engagements, however, the conditions will change. (Beresina.)

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river itself as by the adjacent terrain, and if his artillery can find no suitable positions in the wide and level river valley. Good communications are a condition precedent to punctual arrival of information. All that has heretofore been said in regard to equipping the troops stationed at the river with means for transmitting information applies here likewise.

The use of the narrower streams as obstacles in front of an occupied position (Sauer at the battle of Wörth), instead of as obstacles impeding the movements of advancing hostile troops, as a matter of fact does not belong within the purview of this discussion. All that the Pioneer Field Manual has to say in regard to obstacles in front of a position applies to them, especially the following:

"Extensive obstacles in front of a position—streams, swamps, hamper and prevent the transition to the attack and may oblige the opponent to make undesirable turning movements. They are particularly valuable where it is important to maintain a hold on villages." (Par. 213.)

"Obstacles increase the power of resistance of fortifications and, especially at night, are a protection against surprise." (Par. 243.)

"If obstacles are to render effective service until the last moment, they should be located within very close range of the defender's position and be constantly watched during the night." (Par. 244.)

"Obstacles located in defiladed spaces hamper the enemy when he enters them." (Par. 245.)

These principles should be observed in selecting a position behind a stream, and should be given due consideration in fortifying the position and in taking whatever tactical measures may be necessary to utilize the obstacle.

Perhaps such positions in rear of streams may gain increased importance in the battles between the gigantic armies of the future. In his book "Flankenbewegung und Massenheer," General von Falkenhausen assumes that such a position was taken up on the Neckar and states in this connection:

"Connected positions, strengthened by every possible expedient, or rather positions of enormous extent were used even in the Russo-Japanese war. They will, in all probability, be used still more extensively in future by the defender and, in

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spite of all the modern contrivances at the disposal of the attacker, will be difficult to take. For, turning movements on a large scale have their limits, due to the difficulty of concentrating and of moving large masses, their dependance upon fixed lines of communications, and the time they require to traverse long distances. Especially when an extensive turning movement encounters the corresponding hostile counter-measures, which are invariably to be expected, the resulting combat will take place in extensive positions, as was the case along the line of the Neckar.

"Aside from the obvious weaknesses of the line as a whole, these positions gave the Red armies a firm footing. To bridge the river and to cross it in face of the enemy was under any circumstances a difficult undertaking. If this was attempted under cover of darkness and by surprise, it might have succeeded here and there. But it was far more probable that the well prepared and vigilant enemy, aided by modern technical means, would prevent and repel such attempts so long as his fire power remained unimpaired."

III. REAR GUARD ACTIONS ON RIVER LINES.

The defense of a river line is frequently a direct outgrowth of a retreat, for which special preparations must be made at the river in case the rear guard is obliged to retire across that obstacle under pressure of the enemy. As this very thing may happen contrary to expectations, it is a general rule in retrograde movements to make whatever preparations are necessary at existing or newly constructed bridges in order to ensure a safe crossing even under pressure of the enemy.

It is obvious that during a retreat over a river, as many bridges as possible should be built, and that each one must be able to bear very heavy traffic. Our bridge equipage is in every respect adapted for new constructions, but there is always danger that it may be lost in case the enemy reaches the bridge at the same time with the rear guard. It should, therefore, be used in case of necessity only, especially as there is no good reason why improvised bridges should not be just as safe, provided enough time—in the case of long and difficult bridges, several days, is available for their construction. Even pioneer companies of the second line should be expected to build absolutely reliable bridges.

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The construction of bridges during a retreat requires that pioneers with their bridge trains be sent ahead at a timely moment. Pioneers will also render splendid services in building improvised bridges. It will usually be possible to show the pioneer leader on the map where bridges are needed. It is highly desirable that each bridge site have easy communications, that there be good artillery positions on the opposite bank, and that the bridge be concealed from view and be protected from flanking fire. In order to expedite construction work, it is advisable to make timely reconnaissance with strong patrols, and to carry pioneers and the packs of dismounted pioneers on wagons, etc. The bridge itself should be constructed as quickly and carefully as possible, all available forces, even civilians, assisting in this work. A report indicating where the bridges are located and when they will be ready for use, should be promptly sent to the commander.

Attention has already been called to the great importance of good approaches, free from defiles, without heavy grades and curves, and leading over solid ground. But one will not be able to insist on these requirements in case of a withdrawal from action on a broad front. Roads should invariably be plainly marked and indicated by shaded lights at night. If there is any chance of a mistake being made, sign boards should be posted to indicate the direction of the bridge. The location of bridges in rear of a line of battle and not on permanent roads, should be marked with special care, for example by tall poles crowned with wisps of straw, by smoky fires, and at night by lanterns or by bright fires. In case they can not be clearly indicated by such means, cossack posts must be posted both by day and at night to indicate the route leading to them.

The difficulties in the way of a well ordered passage across a ponton bridge are oftentimes greatly underestimated. In a retreat, when every minute of delay may do incalculable harm to the morale of the troops, the measures for crossing must be worked out with great care and must, if necessary, be carried out with the utmost strictness. They will, therefore, be briefly summarized here, and should receive due consideration in any crossing.

According to the regulations, the senior pioneer officer present at the bridge is, in general, responsible that the passage is

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effected in an orderly manner. In ordinary cases, this will, no doubt, suffice. But if, from any cause, special crowding toward an important bridge is to be feared—and this will often be the case when the enemy follows directly upon the heels of a retreating force, the command at the bridge should be entrusted to an officer of high rank, whose authority will be unquestioned, and a special force of troops placed at his disposal to carry out his orders. He need not worry much about the bridge itself, for that will be taken care of by the pioneers stationed thereon, but should devote most of his attention to the terrain at the approach to and at the exit from the bridge. A pioneer officer with some orderlies should be stationed at least 200 m. in advance of the bridge. He should direct troops to the bridge, transmit to them the bridge commandant's orders specifying the formation to be taken up for crossing, and call their attention to any difficulties, such as sharp curves, steep ramps, etc., that horses and carriages will encounter in approaching the bridge. He should, moreover, maintain communication by means of orderlies with the bridge commandant, in order that the latter may be quickly apprised of the simultaneous arrival of several bodies of troops, of masses of stragglers, of very heavy vehicles, etc. All mounted men and motor cars that arrive singly, should be placed in the column, unless they have obtained the bridge commandant's permission for crossing the bridge out of their turn. Troops that arrive at the bridge before it is clear for their passage, should be directed to leave the road clear and rest alongside of it in some appropriate formation.

The road between the pioneer officer stationed in advance of the bridge and the bridge itself should be lined with sentries or barriers, or both, to prevent any unauthorized or tardy entry into the column.

The officer stationed on the other bank, charged with regulating the departure of troops from the bridge so as to obviate checks on that structure, will have a much easier task. He should, in addition to his other duties, transmit to the bridge commandant all requests for permission to cross the bridge in the opposite direction.

Technical measures play a special rôle on both banks. Damaged pieces of road must be repaired in the shortest possible time, capsized wagons must be removed, the troops must be

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assisted in moving their wagons around sharp turns or over steep ramps, etc. It will be impossible to accomplish all that has to be done unless provision is made for an adequate force of pioneers and infantry, for material for repairing the roads, and for spades, picks, crowbars, cables, etc.

At night, the difficulties will be increased. Provision must be made for ample illumination of the approaches to and exits from the bridge. Flaring torches and fires should not be permitted in the immediate vicinity of the roads and of the bridge, as they make the horses restless.

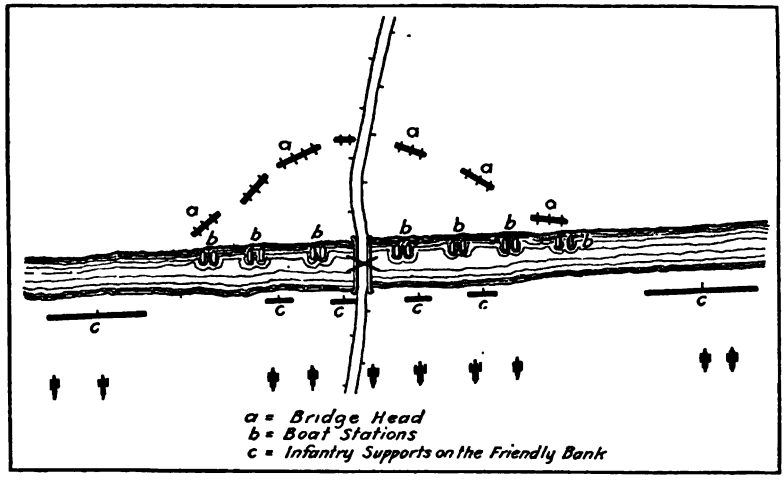

Fig. 35.

Retreat Over a Bridge that is to be Destroyed.

The fight at the bridge with the pursuing enemy will be a defile action of the most difficult type, especially because the enemy can prevent the passage altogether as soon as he reaches the river bank on a flank of the bridge and opens fire with artillery and infantry on the troops crossing it. No attempt will be made to discuss in detail the tactical measures that must be taken in this contingency. Suffice it to say that they consist of holding the ground on the hostile bank and in advance of the bridge stubbornly with infantry (preferably not with the rear guard of the retreating force, but with a special detachment, detached for that purpose at the bridge), of posting strong

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artillery on the friendly bank and of providing extensive cover against hostile flanking fire on that bank. If the holding of the hostile bank is facilitated by bridge heads, so much the better. (See Fig. 35.)

Bridges and ferries are usually destroyed after the bulk of the troops has effected its retreat. Large bridges that were built in time of peace and for peace time traffic, must not be destroyed *except upon the explicit orders of the commander-in-chief*, the commander of an army, or the commanding general of a force operating independently. The destruction of all bridges whose reconstruction will consume only a few days, may be ordered independently by a commander of troops. Pioneer officers, who are usually charged with such demolition work, must have a written order indicating what work is to be done and when it is to be done, or written instructions giving them a sufficiently clear idea of what is to be accomplished to enable them to act independently. (Par. 177, Pioneer Field Manual.) If this were neglected, there might be a repetition of such a disaster as the blowing up of the Elster bridge at Leipzig, which has gained such tragic renown in military history.

The best way to destroy a bridge is to blow it up, though the preparations therefor sometimes consume hours. Floating bridges can be broken up in a few minutes. To destroy a bridge by burning is very unreliable, but, nevertheless, aside from destruction with axe and saw, the simplest method of demolition at the disposal of infantry to which no pioneers have been attached. If troops leave bridges after destroying them, all boats should either be brought to safety or rendered useless, all wooden parts should be carried off, burned or sawed in two. Although it is a good plan to make preparations for quickly destroying a bridge, nothing should be done to weaken the structure prematurely in any manner (for example by partially sawing transoms through), for this might cause it to collapse when a heavy load crosses it.

The bridge should be used to full capacity until the moment it is to be destroyed. All horses, carriages, and the bulk of the infantry should cross it before it is destroyed, leaving only a small infantry rear guard on the hostile bank. This rear guard must hold the enemy at bay until the bridge is destroyed and all service equipage that may have been used in it can be brought

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off in safety. In many cases, however, the enemy will penetrate this thin screening force and strike quickly at the bridge, thus making further work impossible.

Other arrangements for crossing will have to be made for the rear guard on the hostile bank and for any tardily arriving patrols, after the bridge has been destroyed. This can be done by distributing boats and rafts—preferably not belonging to the service equipment, along a broad front in rear of the position of the rear guard (see Fig. 35 at *b*), so as to give it an opportunity of crossing simultaneously at as many points as possible. If practicable, there should be enough boats and rafts to transport the entire rear guard to safety at a single trip. The location of the boats should be indicated by means of tall poles or signs visible at a distance and at night by lanterns or fires. If practicable, the personnel of the rear guard should know the route to the boats and should be given practice in quickly embarking in them.

The rear guard should withdraw on a broad front, under cover of a strong force of artillery and infantry posted on the friendly bank. It should be a point of honor with the pioneers to save every one of the infantrymen employed on the hostile bank for the purpose of protecting their work.[1]

[1] The fight for the possession of the ponton bridge thrown across the Danube below Regensburg, which was used on April 23, 1809, by parts of the Austrian army in their retreat after the battles south of that city, is exceedingly interesting in this connection. One 12-pdr. battery and 5 battalions of Grenadiers were posted on the north bank of the Danube for the protection of the bridge. The rear guard proper, one regiment of infantry and a few batteries, took up a position on the south bank and was opposed by a strong force of cavalry and artillery. In the inextricable confusion of wagons and troops pressing onward toward the bridge, the Austrian rear guard, which had been despatched rather tardily, had not succeeded in reaching and in taking up a position far enough in advance of the bridge. In consequence, the French artillery was enabled to take the bridge itself in flank and to interrupt traffic over it. Nevertheless, by great exertions, the Austrian pioneers managed to hold the bridge, thereby enabling their rear guard, which had, meanwhile, relieved the pressure somewhat by an energetic counter-attack, to retire in safety. But they could not save the bridge itself. They did succeed in breaking off the shore ends and in cutting the anchor cables under the canister fire of French batteries, but the bridge thus left to itself, unfortunately drifted toward the hostile bank and fell into the hands of the French.

As no other arrangements had been made for the crossing of the rear guard, the bridge had to be kept intact until the very last moment to enable the rear guard to escape, and then fell into the enemy's hands. (For details see "Mitteilungen über Gegenstände des Artillerie und Geniewesens," 1912, p. 1186.)

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RIVER CROSSINGS IN "FLANKENBEWEGUNG UND MASSENHEER."[1]

(Study, see Map 2.)

General von Falkenhausen's study on the operations of the gigantic armies of the future in a given situation, has been received with keen interest by our army upon its publication. The author draws his inspiration from the battle of Leuthen, "where his genius for generalship enabled Frederick the Great to lead his numerically inferior army to victory by vigorously striking the far superior enemy in flank." He believes that he can answer the query as to whether such an operation is possible for the massed armies of today, in the affirmative. He contends that "if the movements are skilfully initiated and carried out," it should be feasible "to lead the inferior force against a flank of an extensive hostile line and to roll it up before the bulk of the hostile forces could be put in march for the purpose of turning the scales."

The proof of his contention is adduced in an unusually interesting, broadly conceived and, even in details, exceedingly lucid strategical study, which likewise contains a multitude of ideas for any kind of military investigation. One may work out from it the details of the technique of drafting orders for large units, the leading of cavalry divisions, replacement of casualties and supply, the influence exerted by fortresses, etc. This study is particularly valuable for our purposes because Red and Blue are led over the Rhine and its tributaries during the few days encompassed by the operations, thus furnishing numerous problems in the defense and the crossing of streams, that give an excellent insight into the conduct of troop leading and the employment of troops in this very phase of a war of magnitude.

We shall, therefore, attempt to work out river crossings and

[1] "Flankenbewegung und Massenheer," by General von Falkenhausen, Berlin, 1911. Published by E. S. Mittler und Sohn, Kgl. Hofbuchhandlung, Kochstrasse, 68–71.

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the defense against them, from this study, though many a narrow view based on practical experience had in time of peace, will have to be abandoned. To be sure, the operations themselves and particularly the excellent conception upon which they are based, will be reproduced in general terms only. In many cases the accompanying maps will serve to elucidate and to supplement any intentional brevity of the descriptions. In so far as the general course of the operations is concerned, unimportant details excepted, the present work follows the study closely. The naturally brief discussions on the tactical-technical side of river crossings will be much more readily understood if free rein is given to the imagination, which will delve into details and will conjure up a mental picture showing how the events in any river crossing that occurred in the course of the operations, might have taken place.

The following discussion is likewise to furnish an informal elucidation of the principles enumerated in the chapters on "River Crossings" and on "Defense against a Hostile Crossing."

SITUATION.

A Blue army group composed of the Ist, IId, and IIId Armies, in all 17 army corps and 7 cavalry divisions, after having both flanks turned by a superior Red army group composed of the Ist, IId, IIId, IVth, and Vth Armies and the Ist and IId Reserve Armies, in all 37 army corps and 13 cavalry divisions, fell back before it from the line Metz—Strassburg—Breisach to the line of the Main. The Red army group followed, its right wing crossing the Rhine between Breisach and Strassburg, its left moving along the Moselle. Its advance was retarded by inadequate communications (it being necessary to throw a number of bridges across the Rhine, the Saar and the Moselle) and by delays in front of the fortresses, which were invested.

The Blues brought reinforcements up by rail, the IId Reserve Army (5 army corps) on their left wing, the IIId Reserve Army (3 army corps) in rear of their right wing. The position of the opposing army groups on June 5th, is shown on Map 2.

It was important for the *Blues* to take advantage of the division of the hostile forces caused by the Rhine and its fortresess and to assume the offensive again with the arrival of their

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reinforcements. They still felt superior to the Red forces that had already crossed to the right bank of the Rhine. By moving rapidly by their left, they intended to strike the Red right wing and to defeat it decisively before the Red troops advancing probably between Strassburg—Germersheim—Mayence and north of the latter fortress, could fall upon their own right wing and rear. The advance of Red forces north of Mayence was to be delayed as much as possible by six Landwehr divisions stationed there, and a Red advance south of Mayence was to be prevented by demolishing all bridges over the Rhine that were not protected by fortresses.

The Blue main armies began their flank movement on June 6th. On this and the next day, the *Reds* did not as yet have definite information of the Blue offensive nor of their movement to turn the Red right flank. But one thing was certain, it was absolutely essential to reach the right bank of the Rhine as quickly as possible with all the corps still on the left bank. Accordingly the Red IIId, IVth and Vth Armies were ordered to cross the river as expeditiously as possible. For this, the section of the Rhine between Mannheim and Mayence was assigned to the IIId, that between Mayence and Coblence to the IVth, and that north of Coblence to the Vth Army. The IId Army was to throw two bridges over the Rhine, one on either side of Germersheim, in order to improve its communications to the rear. Leimersheim and Speier were selected as sites for these bridges.

THE SITUATION ON THE RHINE ON JUNE 6th AND THE OPERATIONS FROM JUNE 6th TO 9th.

1. *South of Mayence.*

The Red IIId Army, advancing toward the Rhine south of Mayence with 3 cavalry divisions and 6 corps, intended to cross with 3 corps at Mannheim and with 2 corps at Worms. One corps was to neutralize Mayence. The necessary bridge construction work was entrusted to the XIth and the XIVth Army Corps.

All corps were to put their pioneers and bridge trains well forward in their columns and to place them at the disposal of the two above mentioned corps when they asked for them.

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The Blues had had weak Landsturm detachments (each consisting of one battalion of 3 companies, 1 escadron, and one third of a pioneer company) at the Rhine bridges north of Germersheim, at Worms, Mannheim, and Speier, ever since

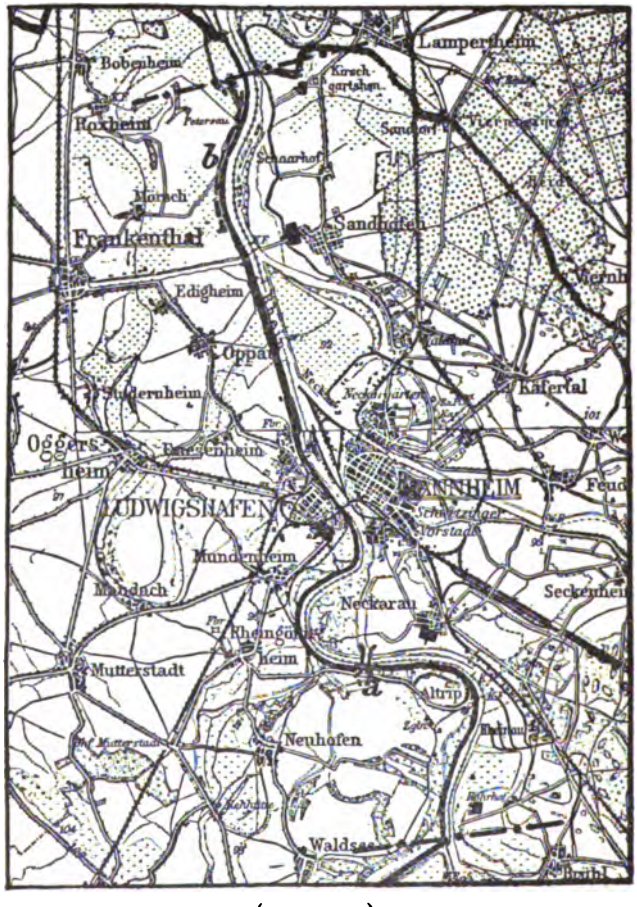

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Fig. 36.

the campaign opened. They had seized all ferries in the vicinity, and had collected all boats on the right bank at the three cities named. The local protection of the Rhine bridges, which had been prepared for demolition, was entrusted to them, and, in

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addition, after completing the destruction—should that become necessary, and after removing all ferries, they were to oppose a hostile crossing as far as their strength permitted.

Let us now turn to the situation at Mannheim and examine it a little more closely.

The protection of the Rhine section Kirschgartshausen—Mannheim—river bend 4 km. south of Altrip (see Fig. 36), was entrusted to the detachment stationed at Mannheim. Its dispositions were as follows: one company of infantry and one fourth escadron was in Sandhofen, one platoon being sent to Kirschgartshausen; the 2d Company and one half escadron had temporarily occupied Ludwigshafen; outguards under non-commissioned officers were posted at the Neckar bridges north-east and east of Mannheim; the 3d Company and one fourth escadron was at Neckarau and covered the Rhine to the southern extremity of the battalion sector, one platoon being posted in advance of Rohrhof. Outguards had been pushed to the Rhine and patrols were ordered sent from Ludwigshafen and across the Rhine in a westerly and southwesterly direction and also along the right bank of the Rhine. Auto busses were held in readiness at Mannheim castle for one platoon of the center company so that it could be quickly sent to any threatened point. All Rhine and Neckar bridges within the sector held by the detachment had been prepared for demolition by the pioneers. All important long distance telephone stations within its sector had been occupied. The detachment was connected by wire with the general headquarters on the Main.

The order for destroying the Rhine bridge was received during the night 5/6 June and was carried out during the early morning hours of the 6th, after all the troops but one platoon of infantry and three troopers (all good swimmers) had been withdrawn. Manned boats were held in readiness in Ludwigshafen to enable them to effect their escape.

The *Red* 6th Cavalry Division advanced against this line on June 6th. Its patrols received a lively fire from the edge of Ludwigshafen. As no reliable information had as yet been received as to the destruction of the Rhine bridge there, and as it was still hoped to get possession of it intact, the bulk of the division advanced against Ludwigshafen, whose streets were obstructed by many barricades, and by noon the town was in

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Red hands, the weak Blue garrison having made good its escape to the right bank of the Rhine after suffering some loss. One cavalry brigade advanced toward the Rhine via Frankenthal, but found the river so strongly occupied by hostile infantry that a crossing by day appeared hopeless.[1]

During the afternoon, a General Staff Officer and the commander of the pioneer battalion of the Red XIth Army Corps, escorted by a strong patrol, arrived in Ludwigshafen to reconnoiter the crossing. This reconnaissance developed that one 90 m. span of the very elevated Rhine bridge had been thrown into the river. To repair this damage quickly was out of the question. It was considered necessary to build a ponton bridge and, preferably to avoid the large city. A suitable bridge site was found at a brick yard 2 km. northwest of Altrip, the width of the channel at that point being estimated at 300 m.[2] As definite information in regard to the strength of the troops on the right bank of the Rhine was not as yet available, and it did not seem improbable that a strong force of troops might have to be thrown across, it was deemed advisable to order up 4 divisional and 2½ corps bridge trains. In view of reports previously received from aviators, however, the corps commander believed that he need not anticipate a stubborn resistance and therefore determined to force the crossing of the Rhine during the daytime. Five companies of pioneers appeared to be requisite for promptly carrying out the enterprise.

It was highly desirable to have the 6th Cavalry Division cross the Rhine as quickly as possible. Its crossing was to be effected during the following night on the apparently but weakly guarded section east of the line Mörsch—Petersau and north thereof. Two divisional bridge trains and two platoons of pioneers were to assist the 6th Cavalry Division and were to arrive in Frankenthal at midnight.

For the purpose of deceiving the enemy and to draw some of his force off, one cavalry brigade made ostentatious preparations to cross opposite Rheingönnheim in the course of the afternoon, and the bridge wagons of the cavalry division were assembled

[1] The cavalry division might, perhaps, have been able to cross the Rhine at once, had it been accompanied by a battalion of infantry.

[2] General von Falkenhausen in his study locates this new bridge in the vicinity of the one demolished, probably because he does not consider the conditions for an advance by Neckarau particularly favorable.

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in Frankenthal. The banks of the Rhine north of the line Frankenthal-Sandhofen were reconnoitered with great secrecy and it was decided to cross there on a broad front. (See the line at *b* in Fig. 36.) The crossing was effected at 2 A.M., June 7th. Two escadrons sent toward the boat ferry west of Sandhofen at 1.30 A.M., managed to lure the hostile infantry posted in Sandhofen to the ferry. By 3 A.M., enough dismounted troopers had been landed without appreciable losses northwest of Sandhofen with the assistance of the pioneers of the XIIIth Army Corps, who arrived punctually on their two divisional bridge trains, to put the Reds in secure possession of the right bank and to enable them to begin swimming their horses across. By 9 A.M. two brigades of the division—minus their wagons, were on the right bank.[1] The crossing of the 3d Brigade as well as of the guns and carriages, over a flying bridge that had meanwhile been constructed, consumed the remaining daylight hours of the 7th. The Blues made an abortive attempt from Sandhofen and Kirschgartshausen to interfere with the crossing.

Meantime, the XIth Corps had made arrangements to concentrate the bridge trains of the XIth, XIIth, and XIIIth Army Corps, which had been placed at its disposal by the Army Commander, on Ludwigshafen. The bridge trains of the XIth Army Corps arrived with the advance guard of that corps at Neuhofen about noon of the 7th. Toward 4 P.M., the leading division of the XIth Army Corps had posted strong artillery southeast of Rheingönnheim and north and northwest of Neuhofen, whose vigorous fire broke down the resistance of the hostile Landsturm company in Neckarau so quickly that the Red infantry crossing east of Rheingönnheim encountered only very little resistance. When the artillery of the 6th Cavalry Division likewise opened fire from the north on the Landsturm detachment at Mannheim, the whole Blue detachment decided to withdraw and retired behind the Neckar, where, toward evening, the heads of the Blue 2d Cavalry Division arrived. The Neckar bridges were not destroyed for the present but, including those in Mannheim, remained in Blue hands. The construction of the bridge southeast of Neckarau (at *a*, Fig. 36) had, meanwhile, begun, but could not be completed until the morning of June 8th, as the bridge trains of the XIIth and XIIIth Army Corps did not arrive

[1] This good showing was possible only because the horses swam in droves.

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until late, due to the long distance they had to march—about 60 km. The Red corps began the passage of the Rhine at 10 A.M. June 8th, and completed it at noon on the 10th.

Events at Worms progressed in a similar manner. Here, likewise, where in the course of June 6th, the Landsturm troops were reinforced by the leading elements of the advancing Blue 1st Cavalry Division, the Reds were unable to get the Rhine bridges into their possession intact. The Red 7th Cavalry Division, reinforced by pioneers and two divisional bridge trains, therefore crossed the Rhine during the night of June 6/7, at Oppenheim, 25 km. north of Worms, without encountering hostile opposition. At Worms itself, after the resistance of small hostile detachments had been broken down by fire, as at Mannheim, a bridge was thrown across the Rhine during June 8th and the succeeding night.

On June 9th, the Red IId Army caused bridges to be thrown across the Rhine at Leimersheim (south of Germersheim), and at Speier. At both places, the right bank was free from hostile Landsturm troops, for they had already been compelled to evacuate their positions at the river by the advance of the Red IId Army on the right bank of the Rhine, and had retired behind the Neckar. The garrison of Germersheim made repeated attempts to destroy the bridge at Speier by floating rafts and boats against it, but these enterprises were foiled by the vigilance of the Red river guard.

2. *North of Mayence.*

As stated above, six Blue Landwehr divisions were available north of Mayence for opposing the advance of the Reds there. The commander of the Landwehr had divided his force into two groups, which rested, respectively, on the fortresses Mayence and Coblence. The divisions remained intact, but small detachments were pushed forward to cover the Rhine directly, and on the left bank of that river a few patrols made vain attempts to maintain their positions against the advancing strong Red cavalry.

If the enemy had crossed within reach of the divisions, the latter would undoubtedly have assumed the offensive against him. But the commander of the Landwehr believed that, in

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view of his comparatively weak force, the best plan would be to delay the enemy as much as possible after the latter had crossed the river, without exposing himself to attack by superior forces, and to draw the hostile corps by suitable operations, away from the Blue main army south to the Main.[1]

Although the Rhine itself was guarded by weak forces only, the Red cavalry divisions, whose leading elements reached the river between Mayence and Coblence on June 6th, did not succeed in throwing adequate forces across to the right bank on that and the succeeding day. Only a few patrols swam across. The advance was, therefore, for the time being at least, halted, and meanwhile the leading elements of succeeding corps of the IVth Army were beginning to arrive at the Rhine.

The Red 12th Cavalry Division, which advanced toward the Rhine north of Coblence, had better luck. (See Fig. 37.) In this locality, the bulk of the Blue 1st Landwehr Division was posted in the district Vallendar—Bendorf; one battalion had occupied Neuwied, and one escadron was stationed opposite Andernach, and formed the northernmost covering force. The Blue patrol service along the river bank between the points occupied was inadequate.—The Red 12th Cavalry Division arrived at Rübenach on the afternoon of June 6th, reconnoitered from there toward Coblence and the Rhine, and received reliable information from air scouts of the massing of strong hostile forces at Vallendar—Bendorf. Its commander did not care to make a wide detour to get across the Rhine, and therefore determined to trust to luck and to attempt a crossing in the gray of dawn on June 7th, at Andernach. During the 6th, the division remained under cover of the heights near Rübenach and only endeavored to obtain information in regard to the local conditions at Andernach and the strength of the hostile troops on the right bank of the river there. After nightfall it moved toward the selected crossing point. During the early morning hours of

[1] It is debatable whether it might not have been better to distribute the Blue Landwehr divisions in cordon formation along the Rhine (from Mayence to a point half-way to Coblence—Bonn). The task of the comparatively weak Blue force, in view of the decided Red superiority, the magnitude of the stream (with its width of 300–400 m.), and the proximity of the fortresses, all favor that solution. Although the Blue forces succeeded, as the subsequent course of events will show, to retard the Reds sufficiently east of the Rhine, they failed to delay their opponent appreciably anywhere along the strong Rhine barrier itself.

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June 7th, one cavalry regiment managed, with such means as were available in the division itself, to swim across the Rhine unobserved between Weissenthurm and Andernach, and to force the completely surprised Blue escadron stationed near Fahr to retire on Rodenbach.[1] Later on, to be sure, this escadron and

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Fig. 37.

the battalion in Neuwied advanced against the Red troops that had crossed; the latter, however, had at once prepared Fahr and Wollendorf for defense and were vigorously supported by

[1] Extensive regulating work that was being done about this time on both banks of the river, facilitated getting the horses into and out of the stream.

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their divisional artillery, which had gone into position directly west of Andernach. Thus, the crossing, which had, meanwhile, been shifted farther down stream, toward Leutesdorf, could be continued, boats found in the vicinity being utilized. Toward noon, two Red cavalry brigades were assembled on the right bank and forthwith advanced on Isenburg.

The commander of the Blue 1st Landwehr Division did not deem it expedient to extend the line still farther northward, as it already stretched for 80 km. along the Rhine. His division accordingly remained in its positions north of Coblence and allowed the crossing of the Red cavalry division to proceed.

The moment had now arrived for the commander of the Red Vth Army to make arrangements for the crossing of his various corps. In this connection, he clearly discerned the difficulties that a crossing and the construction of a bridge at Andernach would encounter in view of the proximity of strong Blue forces. It was calculated that, owing to the width and velocity of the stream, a corps bridge train would not be able to carry much more than a battalion of infantry across in an hour and that the construction of the bridge would consume from 6 to 8 hours. If the hostile battalion at Neuwied and the strong hostile forces at Bendorf were to advance promptly against the crossing point, considerable interruptions would certainly have to be reckoned with. Nevertheless, the Army commander decided to trust to luck, as the 12th Cavalry Division had done, and to effect an accelerated crossing with the XXVth Army Corps at Andernach during the night 7/8 June, but to couple this with a demonstration opposite Engers.

Hostile air scouts, which constantly circled over the approaching Red columns (see Map 2), apparently kept the Blues well informed in regard to the Red advance. To deceive them became indispensable. Accordingly the various corps received orders not to let their main bodies advance beyond the line Lonnig—Ochtendung—Kruft,[1] but to have all the advance guards continue the march eastward on Coblence and to have all pioneers and bridge trains follow them. Thus it happened that Red troops reached Bassenheim and Laffig during the afternoon and that long bridge trains, clearly discernible to the hostile

[1] This is, in minor details, a departure from the description in General von Falkenhausen's study.

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air scouts, assembled there. Extensive reconnaissances were initiated toward Engers and everything done to convince the enemy that a crossing was contemplated there. In Andernach, however, everything was quiet. But detail reconnaissances in preparation for throwing troops across and for constructing a bridge were made. The roads to be used by the bridge trains of the three corps, which were to be united there, were designated and arrangements made for lighting them at night. The last brigade of the 12th Cavalry Division to cross, was to advance to Niederbieber only, but during the night to occupy Irlich, which was free of the enemy, so as to cover the initial operation of throwing troops across.

The Blues in fact expected a crossing to be made at Engers, opposite which the advance guard of the XXIIId Army Corps made a lodgment at nightfall, while, at the same time, attempting to attract the attention of the Blues by making a demonstration with the attached bridge train of the leading division. The 1st Landwehr Division therefore remained in its positions in readiness to attack such covering troops as the enemy might throw across at Engers.

At nightfall, meanwhile, the XXVth Army Corps and all the pioneers and bridge trains of the three Red army corps had begun the march on Andernach. The bridge trains advanced directly to the districts assigned to them at the river (that of the XXIIId Army Corps east of Andernach, that of the XXIVth Army Corps in Andernach itself, and that of the XXVth Army Corps opposite Leutesdorf). Troops were begun to be ferried across the river at once at all points, and by 4 A.M. one brigade of infantry was on the right bank north of Irlich and field artillery of the corps had gone into a position in observation east and west of Andernach. The Blue forces made no move from Bendorf, and, in fact, did not report of the crossing until 5 A.M. To attempt anything now appeared useless to the Blues, and would, as a matter of fact, scarcely have interrupted the bridge work, which had meanwhile begun. The bridge, whose construction was begun at 11 P.M., was completed by 6 A.M. Thus the difficult crossing of the Rhine had been effected without losses.

It was now important quickly to pave the way between Mayence and Coblence for the crossing of the Red IVth Army.

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As already mentioned, the 9th, 10th and 11th Cavalry Divisions, advancing ahead of the IVth Army, had in vain attempted to swim the Rhine on June 6th and 7th. This technically very difficult undertaking had everywhere been foiled by the small detachments that had been pushed to the Rhine by the Blue 2d and 3d Landwehr Divisions, stationed respectively in Rüdesheim and in St. Goar. The commander of the Red IVth Army realized that it would be impossible to throw cavalry across here. He accordingly determined to concentrate at the Rhine on June 8th as many pioneers and bridge trains of the advancing corps as he could make available, and to break through the line of the two Blue Landwehr divisions by surprise, if possible, by force, if he must, at Bacharach and Oberwesel. The execution of this enterprise was entrusted to the XVIIIth and XIXth Army Corps, which arrived with their leading elements at Rheinböllen[1] and Kisselbach (10 km. southwest of Oberwesel) on the evening of June 7th.

Let us now take up in more detail the measures and events that led up to the crossing at Bacharach.

The dangers threatening the troops thrown across, in case they were attacked by superior Blue troops, was apparent even in the crossing at Andernach. In this case, the conditions were similar, as the hostile main forces were at Rüdesheim only 15 km. away. It was, therefore, indispensable to deceive the enemy as to the crossing point. If he was held fast at some point other than the actual crossing point, the difficult terrain on the right bank, which had very few roads running along the stream, would benefit the Reds and might make the crossing succeed. In the case under discussion, therefore, the simplest plan appeared to be to contain the Blue 3d Landwehr Division at Bingen, in other words, to threaten with a crossing there.

The heads of the Red XVIIth Army Corps arrived before Bingen on the 7th. On the afternoon of the 8th, the entire artillery of the corps deployed on the heights near Bingen and opened a vigorous fire on all positions and villages on the right bank of the Rhine wherever Blue troops showed themselves. Toward evening, infantry was ferried to the Mauseturm Island on the pontons of the two divisional bridge trains of the XVIIth

[1] Immediately west of Dichtelbach.

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Corps and everything was done to make the Blue troops on the right bank believe that a crossing was impending.

It would have been exceedingly difficult to hide the movements of the bridge trains on June 7th and 8th from hostile air scouts, which here, likewise, continually circled over the advancing

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Fig. 38.

corps, had the trains marched during the daytime. It was impossible to bring them up to Bacharach in the daytime, for the presence of the long column would assuredly have been reported to the Blues and might have jeopardized the secrecy of the whole enterprise. All the corps had, therefore, been instructed as early as the 7th, not to push their bridge trains (except the two

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divisional bridge trains of the XVIIth Army Corps) too close to the Rhine in the daytime, but to have them continue their march after nightfall and to conceal them until daybreak on the 8th, in the woods that extend along the road leading from Rheinböllen to Bacharach. This order was carried out without appreciable friction, and it was, therefore, easy to bring them and their accompanying pioneers quickly up to the crossing point at Bacharach.

With the exception of the XVIIth Army Corps, which, as already described, made a demonstration at Bingen, everything was quiet during the daylight hours of the 8th on the Red side, but a demonstration was made from Rheinböllen toward Stromberg by troops of the XVIIIth Army Corps for the purpose of deceiving hostile air scouts. After nightfall, however, the entire artillery of the XVIIIth Army Corps went into previously reconnoitered positions on the heights on both sides of Bacharach, infantry quietly occupied the bank of the Rhine as far as a point opposite Caub and Lorch and the pioneers and bridge trains of the XVIIth Army Corps (less two divisional bridge trains), and of the XVIIIth and XIXth Army Corps were brought up to Bacharach. All available pontons—except those of a single divisional bridge train, were quietly carried to the river, deposited in the rear of the railway embankment, and the troops to be thrown across stationed behind them. As there had been ample time to make all the necessary preparations without haste, the dawn of day was awaited with confidence. As soon as it was light enough, the Red artillery directed an overwhelming fire against all occupied localities on the opposite bank, especially against Lorch, Lorchhausen and Caub, where several Blue companies were apparently posted. Soon thereafter, the operation of ferrying troops across was begun, and this was scarcely molested by hostile infantry, which, whenever it showed itself, was at once downed by the superior fire of infantry, machine guns, and artillery. About three hours later, about one Red brigade of infantry had occupied the commanding heights on the opposite bank. Work on the bridge, which was started soon after daybreak, was completed toward 11 A.M. The Blue 3d Landwehr Division had not discovered until it was too late, that it had been deceived at Bingen. As it could no longer hope to achieve success at Bacharach, it retired toward Wiesbaden.—

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Thus, the crossing of the Rhine at Bacharach had, likewise, been effected without serious losses, and the XVIIIth Army Corps began to cross the bridge; the other corps were to follow.

As soon as the Blue 3d Landwehr Division had withdrawn, the Red 9th Cavalry Division, whose crossing had so long been prevented by the Blues, at once began the operation of ferrying troops across at Rüdesheim. In this it was materially assisted by the two divisional bridge trains at Bingen and the pioneer company accompanying them. By nightfall of June 9th, all of it had reached the right bank of the Rhine.

The bridging operation at Oberwesel ran a similar course. The result of the operations on the 8th and 9th of June was, consequently, that reliable bridges were thrown across the Rhine, first at Andernach, and later at Bacharach and at Oberwesel, over which the various corps of the Red Vth and IVth armies passed to the right bank of the Rhine without interruption. We shall later again revert to the movements of the Blue Landwehr Divisions that retired before them.

THE OPERATIONS FROM JUNE 7th TO 10th.

As early as June 7th, the cavalry divisions of the *Red* Ist and IId Armies had clashed with the *Blue* cavalry divisions on the Kocher and the Neckar, south of Mayence. These engagements for the most part ended in favor of the Blues. But the Kocher and the lower Neckar nevertheless remained in Red hands and on June 8th the Red Ist and IId Armies moved into these sectors. On the same day, the Red IIId Army, the XIth Corps leading, began crossing the Rhine bridge at Mannheim and occupied the neighborhood of Weinheim, thus forming a junction with the Red IId Army.

Meantime, the flank movement of the Blue armies had made good progress. The Blue IId Reserve Army, after a series of long marches, had reached the extreme left flank, thereby outflanking the Red troops stationed along the Kocher. The Blue IId and IIId Armies moved directly forward against the front of the hostile line with the object of holding it fast. In this they were only partially successful. The object of the Blue offensive movement was becoming more and more apparent to the Reds. To evade it, the Red Ist Army accordingly retired to the Neckar during the night 9/10 June, the Blue IId and IIId

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Armies following, and on the evening of the 10th, these two forces confronted each other on the Neckar.

While the Reds had so far managed to evade decisive blows on the right flank, their IIId Army, which had crossed the Rhine at Worms and Mannheim, was no longer able to do this. In this locality, the Blue IIId Reserve Army had been transferred to the extreme Blue right flank and by nightfall of the 8th had already gained considerable ground toward the two crossing points. For the Reds everything therefore depended upon their being able to move forward. The troops they had thrown across, were consequently obliged to engage the Blue IIId Reserve Army, which was very shortly afterwards reinforced by the meanwhile arriving corps of the Blue Ist Army. The Reds were confronted by a considerably superior force here. The final result of the two days' fight was that on the evening of the 10th, after suffering heavy losses, the Reds were forced to retreat over the bridge at Worms,[1] which they demolished behind them, and that the Red troops that had crossed at Mannheim were forced back upon their bridge and were barely able to hold the line of the Neckar. The advance of the Red IIId Army had thus been completely checked.

Although the Red commander-in-chief did not as yet consider this failure as decisive, he fully realized that nothing could now change the unfavorable complection of affairs for the Reds, but the corps that had either already crossed the Rhine north of Mayence or were in the act of crossing it. But here, likewise, nothing of note had been achieved. The opposing Landwehr divisions had, indeed, been forced to retire everywhere in an easterly direction, but, according to their instructions, they offered resistance at every turn and retarded the advance of the Red IVth and Vth Armies, which only gradually again were able to deploy on a broad front on the right bank of the Rhine. Thus protracted engagements were fought at Hillscheid (near Coblence), at Gerolstein, at Langenschwalbach, and especially on the Lahn near Limburg. All these fights resulted in the

[1] Unfortunately, the Reds had neglected to construct a bridge head to cover the bridge over the Rhine. A strong work of that character could have been built in twenty-four hours and would have ensured an orderly retreat over the bridge, in the event that such a movement became necessary. This neglect is explainable only by the desire to withdraw as few troops as possible from the fighting line.

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retirement of the Blue Landwehr divisions whenever they found themselves outflanked by superior hostile forces. On the evening of the 10th, two corps of the Red IVth Army confronted two Blue Landwehr divisions at Wiesbaden. On this day, the corps of the Vth Army were as yet unable to gain ground materially beyond the Lahn. The leading corps of the IId Reserve Army had, meanwhile, crossed the bridge at Andernach.

OPERATIONS OF THE PIONEERS UNTIL JUNE 10th.

The resumption of the advance by the Blues after their protracted retreat, made it plain to anyone that a great blow was impending. Everyone on the Blue side realized that he would have to put all his energy into his work in order that success might be achieved. The pioneers marching with the advance guards were likewise animated by this feeling. The map showed plainly that the army would have to cross a number of streams in its advance, the Tauber, Jagst, Kocher, Neckar, and Rhine. All mounted lieutenants of the pioneer companies accordingly accompanied the independent cavalry in order to send back early information in regard to the nature of the streams to be crossed. Corresponding reports were to be sent back by the pioneer officers of the cavalry divisions. The divisional bridge trains were assigned to the advance guards and each corps bridge train marched directly in rear of the leading division of its corps.[1]

But, for the time being, there was nothing for the pioneers to do, not even at the Kocher where strong hostile forces were first encountered. The Blue IIId Army did, indeed, attack the enemy here with artillery, but made no attempt to push the attack, in order to give the Blue IId Reserve Army time to make its enveloping movement. As the bridges over the Kocher later on fell intact into Blue hands upon the retirement of the Reds, no task worth mentioning devolved upon the pioneers, and it was possible to hold them in readiness for the problems that would, in all probability, arise at the Neckar.

Neither were the pioneers of the Red Ist and IId Armies specially employed in bridge construction. From June 9th on, they began to prepare the Neckar bridges for demolition and on the afternoon of the 10th all bridges over that river from

[1] It was impossible to assign more than a single road to each corps.

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Stuttgart to its mouth were destroyed and all ferries interrupted. Part of the pioneers of the Red IIId Army had accompanied the various corps to the right bank of the Rhine and were employed in building several bridges over the Neckar between Heidelberg and Mannheim, for the purpose of improving the lines of communications of their corps. Later on they participated in the demolition of the Neckar bridges.

The use made of the pioneers of the Red IVth and Vth Armies, subsequent to the crossing of the Rhine, needs closer investigation.

At Andernach, where the Rhine is about 400 m. wide,[1] three corps and two divisional bridge trains had been required for the bridge. The latter appeared to be very much endangered on account of the proximity of the fortress of Coblence. If a large number of heavy Rhine barges or rafts were simultaneously released at the fortress, it was confidently to be expected that they would float down on the broad and swift stream as far as Andernach and would become exceedingly dangerous to the bridge. To frustrate any such enterprise required the establishment of an extensive river guard service, and two divisional bridge trains were accordingly detailed for this duty. This guard service began as far up stream as Engers; a flying bridge was built at Neuwied of boats found in that locality, which, it was believed, would render good service in picking up floating objects; and guns were posted near the various guard detachments for the purpose of sinking vessels floated down stream. —As two additional divisional bridge trains had to remain at the bridge as a reserve for protecting and repairing it, a total of six divisional and three corps bridge trains were required at Andernach; in fine, all the bridge trains of the three corps belonging to the Red Vth Army. As the bridge was in constant use from early morning of the 8th until the evening of the 11th, it was impossible to release a part of the trains by replacing some of the service bridge equipage in the bridge with improvised material, for any extensive work of that character would have interrupted the passage of troops.—It was not until the Red IId Reserve Army, which followed upon the heels of the Vth Army, arrived at the bridge, that two divisional bridge trains could be sent after the line corps that had meanwhile advanced, keeping

[1] Estimated.

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two bridge trains of the Reserve Army in their stead as a reserve at the bridge.

For the ferry and bridge work executed during the night from the 8th to the 9th of June at Andernach, all the pioneers of the three corps of the Red Vth Army were employed. It is assumed that these comprised nine companies. Two companies, reinforced by a provisional company formed of disabled infantrymen belonging to the XXVth Corps, remained at the completed bridge, and one was charged with guarding the channel above the bridge. Hence, each corps had only two pioneer companies left, which, with exception of those that needed rest, at once rejoined their divisions during the advance. Their first duty consisted of providing a temporary substitute for the absent service bridge equipage. All commanders of pioneer companies were therefore ordered to requisition boards, rope, hasps, spikes, etc., in the larger villages passed by the column and to carry this along on wagons so that at least a small amount of bridge material might be available. It was extremely probable that a considerable demand for such material might arise on the Lahn. As a matter of fact an action was fought there at Limburg and Dietz by three Red corps against three Blue Landwehr divisions, in which, however, the latter did not await the decision but retired as their mission required. The narrow valley of the Lahn, all bridges over which had been destroyed, was occupied by well concealed Blue detachments distributed over a wide front. The attack of the troops advancing frontally over the river had to be made in face of their fire. The weakness of the attached pioneer force threw the Red infantry practically on its own resources. But good use was made of the hasty bridges constructed by the pioneers at the last halt and carried along on wagons.

The Rhine bridges at Bacharach and Oberwesel required a corresponding number of pioneers and bridge trains. But as the river was narrower at these places than at Andernach, it was practicable to have one or two divisional bridge trains follow each corps.

DEVELOPMENTS ON JUNE 11th.

The decision was brought about on June 11th. The Red Ist and IId Armies, as well as parts of their IIId Army had in-

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trenched themselves behind the Neckar on a line about 100 km. long and extending from the Hohenasperg, south of Besigheim to the mouth of the Neckar at Mannheim. In this position, with the Neckar immediately in front of it at most places, they hoped to ward off the Blue attacks until the anxiously awaited action of the Red IVth and Vth Armies, which were crossing the Rhine north of Mayence, could make itself felt. The Reds were fully aware of the envelopment of their right flank by strong Blue forces, but against these they expected to throw three corps of the Ist Reserve Army, which they had hurriedly withdrawn for the purpose from the troops investing Strassburg and whose punctual arrival they confidently expected. This expectation was not fulfilled. It was not even necessary for the Blues to launch their entire IId Reserve Army (6 corps) to delay the Red Ist Army and to envelop it completely. It was, accordingly, decisively defeated on the 11th and either dispersed or captured on the 12th.

The successes of the Blue left wing were not as yet distinctly felt in the Blue IIId and IId Armies. These were engaged in a stubborn fight on the 11th for possession of the line of the Neckar, which by the afternoon of the 11th had resulted in favor of the Blues at a few places only.

The Blue commander-in-chief was particularly anxious to gain a success on his own right wing, to cross the Neckar there and, by a vigorous advance, to force the enemy away from his bridges at Mannheim and Speier. Along the lower Neckar, the opposing forces were for the time being equal, but the morale of the Red troops had suffered somewhat in the rear guard actions of the preceding days. In order to accomplish the passage of the Neckar, the Blue IId and IVth Corps were ordered to make a surprise attack on the hostile force guarding that river and the Ist and IIId Corps were to make a forced crossing. As the Blues confidently expected to achieve a success, which was to be still further guaranteed by bringing up parts of the IIId Reserve Army, preparations were made at once to throw two cavalry divisions promptly across the Rhine north of Mannheim, in the event that it should become necessary to operate against flank and rear of the hostile troops that were possibly still retiring across the Rhine bridge at Mannheim. For the same reason, the Blue IIId Reserve Army contemplated throwing a bridge

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across the Rhine north of Worms at Rhein-Dürkheim, and accordingly concentrated its bridge trains early at Biblis.

The intentions of the Blue commander-in-chief were completely carried out on the Blue right wing on June 11th. Even though the attempt made by the Blue IId Corps during the early morning hours of the 11th to cross the Neckar had failed, that of the IVth Corps succeeded completely. The Ist and IIId Corps likewise managed to cross the Neckar under cover of a very heavy artillery bombardment. At 3 P.M., Mannheim was lost by the Reds and with it the Rhine bridge there, over which but few troops had been able to escape.[1] Most of the Red troops were forced to retire in a southerly direction in order to reach the bridge at Speier.

Thus the center of the Red position had also become untenable. During the afternoon, the Reds retired all along the line. Evening found the opponents confronting each other, rather exhausted, some 20 km. west of the Neckar; a catastrophe on the 12th had become unavoidable.

OPERATIONS OF THE PIONEERS ON JUNE 11th.

The Blue pioneers expected to find a lot of work to do at the Neckar, and in this they were not deceived. To enable the pioneers attached to divisions to bridge the Neckar, which was from 60 to 90 m. wide, the divisional bridge trains in many of the corps had been reinforced temporarily by parts of the corps bridge trains. Everywhere arrangements had been made to have the pioneers and bridge trains march well forward in the columns.

The pioneers of the IId Reserve Army were the first to be called upon to do bridge work. They had arrived with four corps on the evening of the 10th at the Neckar at and south of Stuttgart. Without encountering any special difficulties, they constructed numerous bridges over the Neckar in this locality during the night to replace the demolished ones.

The pioneers of the Blue IId and IIId Armies had a more

[1] Unfortunately, as at Worms, the Reds had neglected to construct a bridge head to cover the bridge over the Rhine. A strong work of that character could have been built in twenty-four hours and would have ensured an orderly retreat over the bridge, in the event that such a movement became necessary. This neglect is explainable only by the desire to withdraw as few troops as possible from the fighting line.

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difficult task on the Neckar front.[1] Here the Blues were confronted by strong hostile positions and had to cross the river in face of their fire. This could be accomplished with the co-operation of superior artillery and infantry only. But this coöperation did not suffice. Small detachments were, to be sure, thrown across with similar means as at the Lahn and these made a lodgment directly on the hostile bank, but a decisive result was not gained. At the mouths of the Kocher and the Jagst, however, which had been utilized for constructing hasty bridges out of service equipage, the Blues managed, under cover of a vigorous fire, to bridge the Neckar with two foot bridges toward noon, over which their infantry could quickly pass to the left bank of the river. This infantry advanced into positions fulfilling the functions of a bridge head, and toward 1 P.M., two bridges suitable for all arms were completed behind them over the Neckar.

During the afternoon, the Reds began to feel the effect of events that had taken place on the flanks. These events, as already stated, caused the Reds to evacuate the line of the Neckar and to retire to the Rhine. This gave the Blue pioneers the opportunity to bridge the Neckar at many points thereby enabling the Blue corps to regain close touch with the Reds.

The complete success of the Blues was a foregone conclusion and it could be confidently anticipated that within the next few days the Rhine would have to be bridged. But for this all the bridge trains would have to be made available, if practicable. Accordingly one pioneer company of each corps was left at the Neckar to replace the ponton bridges quickly with improvised bridges—preferably built alongside the ones demolished. In addition, one platoon of pioneers had to be left behind for each bridge train built into a bridge, to operate the bridge during the passage of troops and to bring the train up later on after the bridge had been broken off. Speaking generally, therefore, each of the advancing Blue divisions was accompanied by only two platoons of pioneers.

The operations of the pioneers with the Blue Ist Army are particularly interesting.

[1] The Neckar is from 60 to 80 m. wide in this locality and was everywhere unfordable during June.

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The Attempt of the IId Corps to Cross at Hirschhorn.

(See Fig. 39.)

While the 4th Division was to oppose the enemy on the 11th at Eberbach (6 km. north of Hirschhorn), the 3d Division had been ordered to gain the left bank of the Neckar at Hirschhorn during the morning hours of the 11th, and to construct a bridge there for the use of the IId Army Corps. As the right bank was densely wooded, it was scarcely possible to support the crossing with artillery, the timber on the very steep bluffs making it even difficult for infantry to bring fire to bear in support of the operation. But, on the other hand, the left bank opposite Hirschhorn was known to be but weakly occupied by the Reds.[1] As a matter of fact, the Red IXth Corps had only one support here (at *a*), which had pushed a few outguards forward on the narrow peninsula.

The Blues decided to surprise the hostile troops occupying the river, at daybreak on the 11th.

One advance guard of the 3d Division (1 regiment of infantry and 1 battalion of field artillery) had already been brought forward to Kortelshütte, on the evening of the 10th. The artillery went into position there at once, facing in the direction of Krautels Hill, though well knowing that it would not be able to produce any special effect. Two pioneer companies, reinforced by two companies of infantry, stood with one divisional and one half corps bridge trains on the road leading from Ober-Hainbrunn to Hirschhorn. It had been ascertained that the Neckar was about 70 m. wide at Hirschhorn and that it was unfordable.

During the night strong bodies of covering troops moved forward toward Hirschhorn. The pontons were unloaded at a point 800 m. from the river, carried forward from there and by 1 A.M. were deposited in the streets of the village and at the railroad station. The first echelon of troops to be thrown across was posted behind them.

But the Reds had not been inactive. The narrowness of the stream had enabled them to throw a patrol across the river, and this patrol discovered the whole operation. As soon as its

[1] This description deviates in unimportant details from that of General von Falkenhausen.

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report of the enterprise was received at Red headquarters, two battalions were at once placed in march from Moosbrunn toward the crossing point. When the Blues at 2:30 A.M. on the 11th

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Fig. 39.

began to ferry troops across, the latter were received by such a hot fire that, although the first echelon was able to gain a footing on the peninsula, any further ferrying was impossible.

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By dint of great exertions and with considerable losses, parts of the bridge equipage were brought under cover in the streets of Hirschhorn, but most of it was lost when the Red artillery opened fire from Moosbrunn on the village as soon as it was broad daylight. The crossing attempted by the IId Corps had failed, mainly because it was undertaken in an exceedingly unfavorable locality in face of strong hostile forces, and because it had not only no artillery support whatever, but its supporting infantry troops had not been able to make an effective use of their weapons in the wooded terrain. But it does not follow that the attempt was a blunder. It simply did not have luck at the decisive moment. But one may again draw the lesson from this abortive attempt that surprise crossings over streams as narrow as the Neckar at this point, are very difficult to conceal. The noise of the preparations is too easily carried across to the other bank and, in addition, it is usually not difficult for the defender to push patrols across and to get information.

The Crossing of the IVth Corps at Darsberg. (See Fig. 39.)

Like the IId Corps, the IVth Corps had originally planned to get into possession of the left bank of the Neckar by surprising the defenders, and to make extensive preparations for the purpose. When, however, on the evening of the 10th, a pioneer officer from Darsberg reconnoitered across the river and reported that according to the apparently reliable statement of a wood chopper, Neckarhäuserhof and Waldschwimmersbach (5 km. south of Neckarhäuserhof) were free of the enemy and that he himself had not encountered an enemy either on the river bank nor in Mückenloch, it was decided to take advantage of this favorable opportunity and to cross the Neckar at night with as much speed as possible. The opponent obviously did not anticipate that a crossing would be attempted on this difficult, scarcely passable terrain, and had, no doubt under the impression produced by the many discouraging events of the past few days, even neglected to post any outguards.—The direct descent from Darsberg to the river, as a matter of fact, offered great difficulties, but it was necessary in this case to select terrain difficult to traverse, in order to make sure that the enemy would not be encountered. The bridge wagons could advance only a

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few hundred meters southward from Darsberg; then began a steep, narrow descent. Every single piece of bridge matériel had to be carried to the river from here; but the division commander, who was present, gladly placed a whole battalion of infantry at the disposal of the commander of the pioneer company, asking only that the latter provide him quickly with a reliable bridge over the Neckar. Everything thus went forward to the river without delay and without further preparations at the bank, which had been intentionally omitted so as not to attract the attention of hostile patrols that might accidentally be in the vicinity. The pontons arriving first were at once employed in ferrying covering troops across. Additional covering troops followed, and as the impression continued to prevail that the operation had not been discovered, work was started on the bridge, which was completed at 4 A.M. Nothing now stood in the way of the crossing of the leading division, which approached along the road leading to Neckar—Steinach. The other division of the corps, which, at nightfall, had been instructed to make a demonstration below Heidelberg so as to attract the enemy's attention to that point, likewise used this bridge. The action of the IVth Corps on the left bank of the Neckar had a decisive effect in making the situation of the Blues favorable on their right wing.

The Crossing of the Blue Ist and IIId Corps over the Lower Neckar.

As already stated, the Blue Ist and IIId Corps were, for the time being, unable to gain ground on the morning of the 11th, as they were opposed by a considerable force of Reds posted on the left bank of the Neckar between Mannheim and Ladenburg. But when two corps of the IIId Reserve Army took a hand in the fight with their artillery, the hostile resistance in this locality was broken down. The Reds retired toward their ponton bridge at Mannheim and toward the south. The Blue pioneers, which had been held in readiness until now, at once advanced to the river with their bridge trains and, after throwing a few covering troops across, began to construct the necessary bridges. Between 2 and 3 P.M., three bridges had been completed between Heidelberg and Mannheim.

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Crossings made by the Blues over the Rhine north of Mannheim.

(See Fig. 40.)

The commander of the Blue IIId Reserve Army believed that if the Blues were to make the most of the successes they had gained, they would have to cross the Rhine at an early moment and that the first few hours immediately succeeding the disorderly passage of the floating bridge at Worms by the Reds, were better suited than any others for crossing. He accordingly directed the 9th Cavalry Division to cross the Rhine during the night 10/11 June at Rhein-Dürkheim. As the six pioneer platoons and the six divisional bridge trains of the three corps were concentrated at Biblis,[1] it would have been a mistake not to utilize them in the crossing of the cavalry division. The result was that on the morning of the 11th, the 9th Cavalry Division, including its artillery, was in position on the left bank of the Rhine, ready to take a hand in the fight then raging with Red forces at Worms.

The success of the 9th Cavalry Division prompted the wish to gain the left bank of the Rhine with infantry also and to select for that purpose the same point at which the cavalry division had crossed successfully. The success of this operation likewise depended entirely upon the rapidity with which it was executed. The 22d Reserve Division accordingly moved rapidly to Nordheim and began to ferry troops across to Rhein-Dürkheim with the pontons of the six divisional bridge trains. As soon as enough troops had been ferried across, a bridge was to be built. As the bridge equipage of the Reserve Army did not suffice for this, the Rhine being some 300 m. wide at this point, the commander of the IIId Reserve Army requested the commander of the Ist Army to furnish him additional pioneers and bridge trains. But for the present no bridge was constructed. The 9th Cavalry Division reported that a strong hostile column (a division) was approaching from the northwest, apparently from the line of investment of Mayence. If attacked

[1] One platoon of pioneers had remained with each Reserve division. The Reserve corps employed here had for the time being only two Reserve pioneer companies and two Reserve divisional bridge trains. This assumption is made, contrary to the description of General von Falkenhausen, so as to illustrate what pioneers will have to do in a situation like that existing here, when they have only a meagre supply of bridge equipage available.

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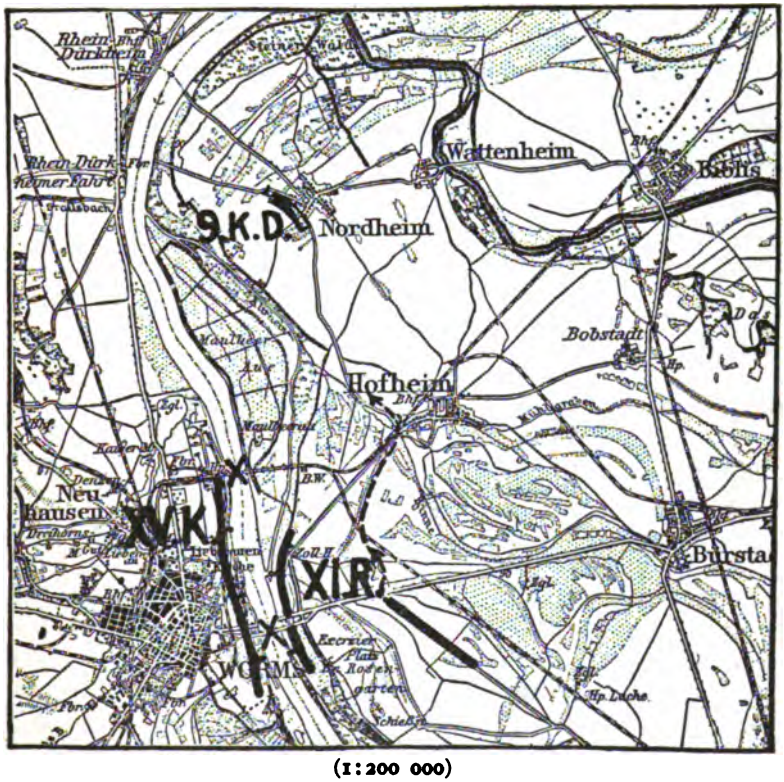
by this superior force, the troops already thrown across to Rhein-Dürkheim would be placed in a very critical situation. But, as they were strong enough to hold the western edge of Rhein-Dürkheim even against attacks made by a superior force, the commander of the 22d Reserve Division decided to discontinue throwing troops across for the present, and to place



(1:200 000)
Fig. 40.

his remaining troops, especially his artillery, in such a position as to enable them to support the troops on the opposite bank. The pioneers, though very tired, crossed to the left bank of the Rhine, assisted the infantry there in preparing Rhein-Dürkheim for defense, and, at the same time, made arrangements for installing a flying bridge[1] to improve the communications

[1] This is a departure from General von Falkenhausen's description.

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between the two banks. The Reds did not attack Rhein-Dürkheim.

Developments on June 11th north of Mayence.

On the evening of the 10th, those parts of the Red IVth Army that had already crossed the Rhine, confronted two Blue Landwehr divisions in advance of Wiesbaden. The latter had been reinforced from Mayence and appeared to be willing to await the Red attack in their well intrenched position. But, as a matter of fact, they evaded the decisive attack on the 11th and retired on Frankfurt, where they again faced to the front behind the Nidda. The Reds followed.

The three other Landwehr Divisions which were still stationed on the Lahn at Kirberg on the 10th, likewise did not wait to be attacked by such parts of the Red Vth Army as were already up, but retired eastward drawing the Reds after them. In the evening, these two forces confronted each other about Bad Nauheim.

Neither the Blue nor the Red pioneers found much employment in surmounting streams on this day.

DEVELOPMENTS ON JUNE 12th.

All that was necessary south of the Main on June 12th, was to pluck the fruit that had ripened on the day before. The Reds realized their hopeless predicament and attempted by a night march to reach the bridges over the Rhine at Speier and Leimersheim, before the Blues. But their retirement was soon discovered by the Blues, who did everything in their power to force them away from these crossings. In spite of desperate Red resistance, both bridges fell into the hands of the Blues, and in the course of the day the Red Ist, IId, and parts of the IIId Army had to lay down their arms before Germersheim. A victory that exceeded all expectations had been won. It, moreover, caused the Red forces north of the Main to face about promptly and to make strenuous efforts to regain the left bank of the Rhine by means of the bridges they had built.

For following up their success still further, the Blues had five perfectly good bridges available over the Rhine between Mayence and Strassburg, and a sixth was to be built at Mannheim on

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the 12th by the IIId Reserve Army. For this work there were available, for the present, only 4 Reserve divisional bridge trains, which were still opposite Rhein-Dürkheim; the equipment of two Reserve divisional bridge trains was used as a flying bridge to keep open the communication with that village.

Considering the small amount of bridge equipage available, the pioneers of the IIId Reserve Army would scarcely have been able to complete the bridge at Mannheim by the morning of the 13th as ordered, had they not found a good deal of Red bridge matériel at Mannheim, which had been used in a bridge that the Reds had built there, and which they had not succeeded in destroying altogether. Nevertheless, the construction of the bridge consumed twelve hours, although infantry had been detailed to assist in the work.

SKETCH OF SUBSEQUENT OPERATIONS.

June 13th was a day of rest for the exhausted Blue troops south of the Main. But the IIId Reserve Army made the necessary preparations via Mannheim (and the flying bridge at Rhein-Dürkheim), for the resumption of the operations. These were to consist of an advance in a northwesterly direction against the flank of the Red Armies retreating north of Mayence, thereby forcing them either to cross to neutral territory or to expose themselves with Metz and Diedenhofen in their rear, to a similar disaster as that which overtook the Red armies south of the Main at Germersheim.

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THE DEFENSE OF THE LOWER ODER.

(A Study.)

(See Maps 3 and 4 and any General Map of North Germany.)

THE TERRAIN.

As sketched on Map 3, the lower Oder flows from Freienwalde via Angermünde and Ober-Ucker Lake, through the valley of the Ücker into the Kleine Haff. The river is generally about 400 m. wide, and below Torgelow from 500 to 600 m. wide. The velocity of its current varies from 1 to 1.5 m. Prenzlau and Pasewalk lie on the right bank, Ückermünde on the left bank, and Torgelow on both banks of the Oder. The only highway bridges over the stream north of Unter Ücker Lake are located at Prenzlau, Pasewalk, and Torgelow. One railway bridge spans the river west of Göritz; all other railroads cross the river over some highway bridge. There is a flying bridge at Ückermünde and boat ferries are operated at Nieden and Liepe. The marshy meadows, etc., that extend along the Oder are passable for deployed infantry, but not for bodies of troops in close order, nor for horses and carriages, which must confine themselves to roads. East of Belling and east of the line Bandelow—Ellingen there are, however, extensive swamps that are impassable except for single pedestrians.

INITIAL SITUATION.

Blue Armies, in friendly country, are concentrating toward the end of May, east of the Oder on the line Greifenhagen—Reppen.

Red Armies, to all appearances approximately 15 army corps and 4 cavalry divisions, are advancing against the Blue line. According to reports received from air scouts, the infantry of the Red corps reached the approximate line Güstrow—Havelberg on the afternoon of May 21st, and a strong force of hostile cavalry arrived at Treptow on the Trebel and at Neu Brandenburg.

The 1st and 2d Landwehr Divisions (see table of organiza-

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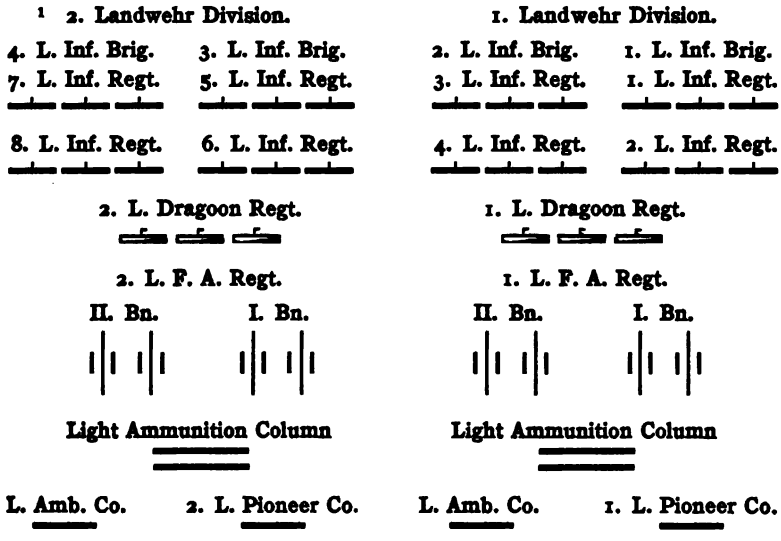
tion)[1] assembled at Pasewalk and commanded by the senior division commander are to cover the Blue right flank and to prevent the Reds from crossing the Oder from Prenzlau inclusive, to the Haff. Highway and railroad bridges are to be destroyed, if necessary. The line entrusted to these two divisions is prolonged toward the south by advanced detachments of the Blue Army. An attack from the Baltic and a hostile advance by Usedom and Wollin are not to be anticipated. Blue cavalry (2 escadrons from each division) is at Strassburg and is reconnoitering toward the west. Contact has been gained with hostile cavalry patrols only. The bridges and flying ferries over the Oder are already guarded by small Landsturm formations (one platoon of infantry and a few troopers at each).

On the afternoon of May 21st, the commanding general

[1]



Attached Troops:

1. and 2. Reserve Machine Gun Companies
1. Reserve Divisional Bridge Train
Searchlight Section (with 200 flare projectors and ammunition)
Reserve Divisional Telegraph Section
Aero Squadron
Four detachments of Landsturm Infantry (1 platoon and a few troopers at each of the bridges and at the flying bridge).

Note: The organization of the Landwehr Division has been arbitrarily assumed.

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(commander of the 1st Landwehr Infantry Division) at Pasewalk, is oriented in regard to the situation and his mission. He therefore directs that the general staff officer assigned to him and the senior pioneer officer report to him at 6 P.M., for the purpose of rendering a combined report as to the defense of the Oder; that the commanders of the two divisions, the commanders of the two pioneer companies, and the commander of the division telegraph section report to him at 7 P.M., and that orders will be issued at 8 P.M.

What will be the estimate of the situation upon which the two first-named officers will base their report?

ESTIMATE OF THE SITUATION.

The Terrain.

Neither of the two officers is familiar with the terrain in question. But from the Oder bridge at Pasewalk they have gained an idea of the tremendous size of the stream. In addition, by making inquiries of a water works official, they have verified the presence of all the other bridges and ferries shown on the map and have been informed through previous reports sent in by the cavalry to what extent the marshy meadows and the swamps along the Oder are passable. Beyond this, they will have to endeavor to judge the terrain by the map.[1]

[1] It is obvious that this will give rise to mistakes that can only be rectified by local reconnaissance. Nevertheless, a thorough study of the map is requisite in order to obtain as quickly as possible the necessary information on which to base the order, which is to be issued on the 21st.

In making their estimate, however, these two officers should not confine themselves to matters that the commander will have to put in the order. They should, on the contrary, also place themselves into the position of subordinate leaders, in order to get a clear conception of the whole situation from every angle and to enable the commander—as is unavoidable in the present case, to prescribe even details to subordinate leaders if their orders do not absolutely assure success.

The preliminary work includes, in the first place an estimate as to a suitable distribution of the troops along the stretch of river to be protected. The best way to do this, is to note the distribution of troops and other measures directly on the map. (See Map 3.) Such notations, however, are not designed to restrict the subordinate leaders in details, but are simply to give the commander a general idea of the conception the reporting officers have of the solution of the problem and to enable him to express his own views at the subsequent discussion with his subordinate commanders and to take proper measures for the reconnaissance that has still to be made of the whole river line.

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The terrain to be protected along the line of the Oder may be directly divided into three sectors:

Ist Sector: Extending from the Haff to Bauerort (5 km. north of Pasewalk), inclusive;

IId Sector: Extending from Bauerort, exclusive, to Göritz, inclusive;

IIId Sector: Extending from Göritz, exclusive, to Unter-Ücker Lake.

The Ist Sector is about 27 km. long and extensive woods cover both banks. Those on the left bank are traversed by numerous roads and logging paths and would, without doubt, afford the enemy complete concealment in approaching the river.

A narrow strip of meadow—in many places shown as marshy on the map, separates the woods from the river, except in the north, where it broadens out into a wide swamp. In the latter locality, where the Oder is some 600 m. wide, artillery positions can be found only a considerable distance away from the river. Along the remainder of the sector, however, hostile artillery can go into position at the edge of the woods only—though it can get there without exposing itself and can support a crossing undertaken in that locality.

In the northernmost 5 km. of the IId Sector, both banks of the Oder are bordered by marshy meadows, which make it extremely unlikely that a crossing will be attempted there. This practically impassable terrain is joined in the south by a stretch some 10 km. long, which extends as far as Nieden and appears to be particularly vulnerable. Although many narrow, marshy meadows extend along the banks here also, a great force of artillery could easily be deployed on the long ridge that runs parallel to the river on the left bank.

It is not likely that the valley from Nechlin to the line Göritz—Bandelow (4 km.), will be used for enterprises of any magnitude. But a demonstration may be anticipated in the narrow valley between Bandelow and Göritz.

The IIId Sector is about 9 km. long, and its entire northern portion is unsuited to extensive hostile enterprises. The marshy meadows, lakes and arroyos would, undoubtedly, make them extremely difficult. Prenzlau itself, however, is a possible crossing point, but even there nothing but secondary operations need

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be anticipated, if the eastern shore of the Unter-Ücker Lake, which by no means precludes hostile operations, is properly guarded by the Blue army prolonging the line of the Landwehr divisions. Whether this has been done should be promptly ascertained.

Probable Intentions of the Enemy.

If the Reds continue their advance and if, as may be assumed, they have adequate information of the Blues, they will, undoubtedly, move the bulk of their force directly against the Blue armies now in the process of assembling. But this does not preclude that hostile forces, superior to the two Landwehr divisions, may attempt to advance north of the Unter-Ücker Lake. Should this occur, the Landwehr divisions, thrown on their own resources, would have to accomplish a prodigious task. If the stream is inadequately guarded, the simplest thing for the Reds to do would be to force a crossing in the neighborhood of Papendorf—Nechlin, under cover of strong artillery, if practicable, that of several corps, including heavy artillery. A crossing at this point would, likewise, no doubt, fit well into the strategical plan of the Reds, as it leads quickly to the right flank of the enemy. The effect produced by the hostile artillery may be so overwhelming that the Blue artillery will not be able to open up at all, and that it will even seem perfectly hopeless to launch the Blue reserves against any Red troops that may possibly have been thrown across the river.

But if the Reds find so many Blue troops in good positions and their measures for defense so excellent as to make a crossing south of Pasewalk too risky, it may be expected that they will attempt to cross elsewhere.

The terrain at Prenzlau would be the first to merit consideration. A crossing there would be particularly effective strategically, as the Reds could then penetrate between the Landwehr divisions and the rest of the Blue army, thereby, in all probability, obliging all the Blue troops north of the crossing point to beat a hasty retreat. But the local conditions at Prenzlau itself and north thereof are entirely too unfavorable. Lake Blindo and the Unter-Ücker Lake restrict the terrain considerably and Prenzlau itself is by no means a desirable crossing point. Nevertheless, demonstrations and secondary operations may well be expected there.

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The next best locality for a crossing would appear to be the Ist Sector, particularly the stretch Torgelow—Bauerort.

That the enemy might attempt to cross here, at least with his cavalry, is by no means beyond the bounds of possibility.

The most difficult task that the Landwehr divisions would have to face would be if a greatly superior enemy attempted to cross simultaneously at a number of points. But the Blues must be properly prepared against such a contingency. It should be remembered, however, that in view of the occupation of the right bank of the river, the enemy would need the bridge trains of three or four corps in order to cross the Oder at one point, in other words that practically half of the whole Red army would have to advance against this part of the Oder, if they actually contemplated crossing that river at two points.

The principal interest of the Blues will, therefore, be centered on the line Pasewalk—Nieden. But the sector north of Bauert, since it is rather vulnerable, must be adequately protected and the other parts of the river line must be so strongly occupied as to frustrate secondary operations there.

General Dispositions of the Blues.

The plan considered first contemplated that small detachments be pushed foward to the Oder, that the bulk of the two divisions be held in reserve either in one or in two groups, say at Löcknitz (at the eastern edge of the map) and at Brüssow, and that the offensive be assumed with it against any hostile troops thrown across. But this method of defending the river does not appear to be promising, as there is danger that the reserve might arrive too late, and, in addition, as there are not enough troops available for it. This is particularly true of the most vulnerable stretch, the center sector. If supported by strong artillery posted on the line Papendorf—Nechlin, a crossing attempted in this sector would surely succeed, if the river line were but weakly occupied by the Blues. It would be hopeless, however, in view of the fire of the hostile artillery, even for a strong body of Blue infantry to advance against the hostile troops that have been thrown across. As a matter of fact, such an advance would probably not get much farther than the Pasewalk—Göritz chaussée. This would give the Reds ample time to build a bridge over the Oder—a task that will consume

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from 6 to 8 hours, and they would then have a free hand. Once the Reds have gained the right bank with strong forces, the Blue Landwehr divisions would surely not be able to maintain their position long against a superior enemy.

In the case under consideration, such a method of defending the river has very little chance of succeeding. It would not effectively bar the lower Oder even for a short time only. The most that could be expected of it would be that it would delay the enemy's forces for a little while. It would be far better to occupy a broad front having but little depth along the river itself. This would make it possible to frustrate the enemy's attempt to cross while his troops are still on the water. But this front must be so closely occupied that, if any hostile troops should actually get across, they will meet the fire of small or large bodies of defenders, which will retard their deployment and ferry service until the defender's reserves can advance to make a counter-attack.

Whether this or that point should be held more strongly than others, will depend upon the measures taken by the enemy. It would, therefore, be a mistake to put the bulk of the troops prematurely into the first line. The commander should, on the contrary, detail a strong general reserve (5 bns., ½ escadron, and 3 btrs.), which he should, for the present, post in rear of the most threatened points, as a general reserve for the Ist and IId Sectors.

If the troops are disposed in this manner, however, the commanders of the different sectors will not be able to hold out strong local reserves of their own. But this is not necessary, provided the line of resistance at the river, in the sub-sectors defended independently by the regiments, is made strong enough.

One proposition still remains to be weighed, viz., whether the construction of strongly fortified bridge heads having a radius of 3 or 4 km., on the left bank of the Oder, in advance of the bridges at Pasewalk and Prenzlau, is included in the mission of the Blue divisions, or may be considered as a suitable solution of the problem. This proposition was at once rejected. The commander-in-chief of the Blue armies apparently does not, for the present, seriously consider a Blue advance over the lower Oder, otherwise he would, undoubtedly, have ordered such

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bridge heads to be constructed. Besides, the Landwehr divisions are too weak to assume the offensive-defensive in face of a superior enemy. But it does not follow that either strong or weak forces should not be left for the present on the west bank of the Oder. Such troops, however, are to act as a covering force, to serve as supports for patrols, and to make the hostile reconnaissance more difficult. But, above all else, they are to compel the emeny to attack and thereby force him to show his hand more or less.

If the commander shares these views, the following distribution of troops should be submitted for his approval:

Ist Sector: Haff—Bauerort, inclusive.
Commander: Commanding General, 1st Landwehr Infantry Brigade.

Troops:

1. L. Inf. Brigade 1. L. Drag. Regt. (less 3. Esc.) 2. L. Drag. Regt. (less 3. Esc.) 1 Btry. 1. L. F. A. Regt. ⅔ 1. L. Pio. Co. & Res. Div. Br. Tr.	Total: 6 bns., 4 esc., 1 btry., ⅔ Pio. co., with Br. Tr.

IId Sector: Bauerort, exclusive—Göritz, inclusive.
Commander: Commanding General, 2d Landwehr Division.

Troops:

4. L. Inf. Regt. 3. L. Inf. Brigade 3. Esc. 1. L. Drag. Regt. (less 1 plat.) 2. L. F. A. Regt. (less 4. Btry.) 1. & 2. Reserve M. G. Cos. ⅓ 1. L. Pio. Co. ⅔ 2. L. Pio. Co. Searchlight Section.	Total: 9 bns., ¾ esc., 3 btrs., 1 Pio. co.

IIId Sector: Göritz, exclusive—Prenzlau, inclusive.
Commander: Commanding General, 4th Landwehr Infantry Brigade.

Troops:

III. Bn. 7. L. Inf. Regt. 8. L. Inf. Regt. 3. Esc. 2. L. Drag. Regt. (less 1 plat.) 4. Btry. 2. L. F. A. Regt. ⅓ 2. L. Pio. Co.	Total: 4 bns. ¾ esc., 1 btry., ⅓ Pio. co.

General Reserve:

No. I. Commander: Commanding General, 2d Landwehr Infantry Brigade.

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Troops:

3. L. Inf. Regt. 1. plat. 3. Esc. 1. L. Drag. Regt. 1. L. F. A. Regt. (less 1. Btry.) Aero Squadron Reserve Div. Telegr. Section.	Total: 3 bns., ¼ esc., 3 btrs.

No. II. Commander: Commanding Officer, 7th Landwehr Infantry Regt.

Troops:

7. L. Inf. Regt. (less III. Bn.) 1 plat. 3. Esc. 2. L. Drag. Regt.	Total: 2 bns., ¼ esc.

Dispositions in the Sectors.

Ist Sector. As already stated, it is not exactly probable that the enemy will attempt to cross the river in the Ist Sector for the present. But, should he do so, it is more than likely that he will select the more southerly portion (at Torgelow and south thereof) as his crossing point, rather than the wide northern reaches of the river. The commander of the sector will, therefore, probably divide his sector into two sub-sectors, each held by one regiment, and detail the sector reserve from the northern regiment. (See Map 3.)

The whole situation demands that the left bank of the river in his sector be held as long as possible. Ückermunde and Torgelow, behind which the ferry and bridge should remain intact for the present, should each be guarded by two companies, and like Etappe stations (see par. 251, Pioneer Field Manual), fortified so strongly that they can resist even an attack made by a cavalry division reinforced by a few companies of infantry. Between these places, small, well intrenched detachments about the size of platoons, should remain for the present on the left bank, say at Jägersteig, west of Gumnitz, in Hammer, and in Liepe. Between them, stationary patrols—with communication by boat in rear, can occupy the left bank and prevent hostile reconnaissance. But, above all else, the cavalry should remain on the left bank, should push detachments forward to the railway leading from Pasewalk to the northwest, and should be instructed to maintain contact with the enemy and to gain information of his intentions.

If the Reds do not intend to cross in the Ist Sector with a strong force of cavalry, but with the bulk of their force, and should, in consequence, strong hostile infantry make a vigorous attack

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against the Blue troops on the left bank of the river, the supporting points held by them must be evacuated in time and bridges and ferries must be destroyed. The troops previously employed on the left bank will then constitute an additional reserve at the disposal of the regimental commanders, which they can use to reinforce the after all very weak line of resistance on the river bank, as soon as the enemy makes a serious effort to cross.

It goes without saying that the commander-in-chief should shift at least his general reserve No. I into the threatened sector.

The battalions detailed to hold the line of resistance on the right bank can not very well escape covering a broad front. They should, in fact, make the enemy's reconnoitering patrols believe that the right bank is held in force, in order to increase the enemy's natural disinclination to cross north of Pasewalk. That the cavalry, when it can no longer maintain its position on the left bank, will likewise be drawn upon to guard the right bank (particularly perhaps in the northern sector) is obvious. Whether it will be possible to use the Torgelow—Uckermünde R. R. for shifting troops will have to be determined by local reconnaissance.

The attached battery had best be used for immediate defense of the river bank. It should be split up into platoons and the latter posted in prepared gun pits, preferably at bends in the river in the southern sub-sector, where they can enfilade the channel.

One platoon of pioneers is assigned to each sub-sector, the divisional bridge train being assigned to the southern sub-sector, where its pontons will augment the means available for ferry service.

The supports and outguards should intrench their positions. In addition, it would be a good plan to ascertain whether it is feasible to construct abatis along both banks of the river on as broad a front as possible, particularly at points that appear to be vulnerable, and this will depend entirely on local conditions. The work of constructing such abatis does not in itself offer excessive difficulties. According to par. 378, Pioneer Field Manual, 50–80 men can fell one hectare of timber in 10 hours. Hence a company of infantry, provided it has the necessary tools, could in a single day no doubt build abatis 10 m. wide and 3 km. long—quite a respectable performance. But if it is contemplated

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to construct abatis, it is indispensable that sufficient tools be provided, a task that is the business of the senior pioneer officer, who is attached to the staff of the commander. If sufficient tools can not be procured in Pasewalk, an attempt should be made to obtain them by rail from Stettin.

IId Sector. The commander of this sector will, no doubt, divide it into three sub-sectors, each defended by one regiment, and detail one battalion of the regiment holding the right sub-sector, as a sector reserve.

Whereas the protection of the northern sub-sector does not offer any difficulties at all, the defense of the two southern sub-sectors requires considerable thought. This is obviously the most vulnerable part of the whole river line. If the enemy should attempt to make a forced crossing here in the daytime, he could bring such an overwhelming artillery fire to bear, as already stated, that the position of the Blue detachments, if they are at all exposed at the river, would become untenable. The contest between the weak Blue artillery and the superior hostile artillery, is bound to result in a speedy silencing of the former, and any movements of Blue reserves in the open within artillery range will then be impossible.

The last consideration is particularly worthy of notice. Speaking generally, it is a cardinal principle of every river defense, this one included, to hold strong reserves in readiness in rear, or to concentrate them at the hostile crossing point, for the purpose of attacking any hostile troops that may have managed to get across and of throwing them back upon the river. In the case under discussion, this would not produce any results. In view of the overwhelming Red artillery fire, the Blues could not move any large bodies of troops anywhere on the perfectly open right bank. Nothing but an extensive use of field intrenchments can remedy this state of affairs along this stretch of about 10 km. Field intrenchments must be used, otherwise the enemy may, perhaps, be able to break down the Blue resistance at the river in a very few hours and force a crossing. Not only the supports and outguards, but platoons and companies farther in rear, should dig themselves in. Their trenches should be so located as to permit fire to be brought to bear, if practicable, on the channel itself, but at any rate, on the terrain between the supports. (See Map 4.) If the enemy, nevertheless, effects a

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landing under cover of his artillery, he should, wherever he turns, encounter new intrenchments that will prevent his further advance. He must be compelled to launch an attack with weak forces that he can not reinforce except gradually, on a fortified position directly in front of him, against which, hemmed in as he is on all sides, he can not make any headway in the daytime. After nightfall, when the hostile artillery will no longer be able to observe its fire, the reserves brought up from all sides, must then throw the enemy back upon the river.

If the enemy does not intend to cross in the daytime under cover of his artillery, but attempts a surprise crossing at night or at gray of dawn, the comparatively strong occupation of the river bank will suffice to frustrate the enterprise while the hostile troops are still on the river. Companies that the defender has held back in reserve should promptly attack any enemy troops that have managed to get across. The machine gun companies and one or two batteries should be used in the line of resistance on the river bank where they can bring frontal and enfilading fire to bear on the channel. The battery held in reserve by the commander of the sector can go into previously prepared positions at night and can fire upon the roads leading to the Oder from Papendorf, Brietzig and Nechlin, in case the enemy is known to be moving troops over them. The searchlight section should likewise be assigned to the IId Sector, as this is the most vulnerable part of the whole river line.

Detachments, each consisting of a platoon of infantry and some cavalry, should remain for the present on the left bank at Pasewalk, Papendorf, Brietzig and Nechlin, and should not retire to the right bank until hard pressed. The bridges over the Oder should remain intact for the present.

In the IIId Sector, the defender's attention should principally be directed upon Prenzlau and its vicinity. One regiment, which should intrench its position as was done in the IId Sector, will suffice for the proper protection of this sector, an additional battalion being detailed as sector reserve.

The bridge at Prenzlau should not be demolished until specific orders to that effect are received. The left bank should, for the present, be held at several points by infantry and cavalry.

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The General Reserve and Other Dispositions.

The general reserve should, for the time being, be posted in Polzow and Zerrenthin, and in Damarow, being transferred, if need be, to the sector that is threatened. Its first duty is to assist the troops in the IId Sector in preparing that sector for defense, and to prepare good road communication for itself to all sectors.—Telephone communication should be established all along the river line, the public lines, augmented by the service equipment of the Telegraph section and of the troops being utilized for this purpose. Public lines should be used to connect headquarters of the Landwehr divisions with headquarters of the main Blue army.—The aëro squadron should get its instructions direct from the commander. Commanders of sectors should be directed to organize an efficient scout service in addition to the patrol service.

The enemy's main forces are as yet some 120 km. from the Oder, his cavalry masses some 50 km. No serious attempts to cross need, therefore, be anticipated until several days have elapsed. At the same time, it would be a mistake not to organize the defense effectively until danger is imminent. Even the crossing of the river by a few hostile cavalry patrols is highly undesirable, and must be prevented. If every unit at once moves into the sector to which it was assigned, it will have ample time to become familiar with its task, to construct the necessary intrenchments and roads, and to get into shape in every respect so as to be able to give the enemy a warm reception.

DRAFTING THE ORDER.

If the commander shares these views, the order, which has already been tentatively drafted and is consonant with them, can be issued. In addition, however, a draft should be made of the verbal orders that must be given to the commanders of sectors, of the pioneers, and of the telegraph section.

The order should read about as follows:

Troops:

Ist Sector.
(Haff—Bauerort, inclusive.)
Commander: Comdg Gen. 1. L. Inf. Brig.

1. Information of the enemy, etc., etc.
2. The reinforced 1. and 2. Landwehr Divisions, under my command, are to prevent the enemy from crossing the ODER along the line HAFF—PRENZ-

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1. L. Inf. Brig.
1. L. Drag. Regt. (less 3. Esc.)
2. L. Drag. Regt. (less 3. Esc.)
1. Btry. 1. L. F. A. Regt.
⅔ 1. L. Pio. Co. with Res. Div. Br. Tr. & 100 flare projectors & amm.
Landsturm Det. at Ückermünde & at Torgelow.

IId Sector.
(Bauerort, exclusive—Göritz, inclusive.)
Commander: Comdg Gen. 2. L. Div.
4. L. Inf. Regt.
3. L. Inf. Brig.
1. & 2. Reserve M. G. Cos.
3. Esc. 1. L. Drag. Regt. (less 1 plat.)
2. L. F. A. Regt. (less 4. Btry).
⅓ 1. L. Pio. Co.
⅔ 2. L. Pio. Co.
Searchlight Section & 80 flare projectors with amm.
Landsturm Det. at Pasewalk.
2. L. Amb. Co.

IIId Sector.
(Göritz, exclusive—Prenzlau, inclusive.)
Commander: Comdg Gen. 4. L. Inf. Brig.
III. Bn. 7. L. Inf. Regt.
8. L. Inf. Regt.
3. Esc. 2. L. Drag. Regt. (less 1 plat.)
4. Btry 2. L. F. A. Regt.
⅓ 2. L. Pio. Co., 20 flare projectors and amm.
Landsturm Det. at Prenzlau.

General Reserve No. I.
(in Polzow and in Zerrenthin.)
Commander: Comdg Gen. 2. L. Inf. Brig.
3. L. Inf. Regt.
1 plat. 3 Esc. 1. L. Drag. Regt.
1. L. F. A. Regt. (less 1. Btry.)
Res. Div. Telegraph Section
Aero Squadron.
1. L. Amb. Co.

LAU, inclusive. Support can not be expected. Our main army will prolong our line southward.

3. The troops will move into their sectors on the right bank of the ODER to-morrow morning and will at once prepare them for defense. Each regiment will be held responsible for the defense of the sector assigned to it and will strengthen its position by intrenching. If the enemy attempts to cross, he must be repulsed before he can reach the right bank.

4. In the Ist Sector, the left bank of the ODER will be held for the present. To this end ÜCKERMÜNDE AND TORGELOW will be strongly occupied and prepared for defense. Small detachments will be posted on the left bank between the two places named. The left bank will not be evacuated by the covering troops except at points where strong hostile forces advance against them. The attached cavalry will push forward and endeavor to gain information from a flank of the movements of the enemy.

In the IId and IIId Sectors, small covering detachments will remain for the present on the left bank of the ODER.

The general reserve will send 3 bns. to Rollwitz and 2 bns. to the TANGER BACH so as to arrive at those points by 1 P.M. to-morrow, to assist in preparing the IId Sector for defense.

The aero squadron will receive special instructions.

5. All bridges and ferries will remain intact for the present, but will be prepared for demolition, in so far as this has not already been done. They will not be destroyed, if a hostile attack is imminent, except upon my express order.

All the larger communities along the ODER have already been instructed to collect on the right bank all the boats found in their jurisdictions. The execution of this order will be supervised in each sector.

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General Reserve No. II.
(in Damarow.)
Commander: C. O. 7. L. Inf. Regt.
7. L. Inf. Regt. (less III. Bn.)
1 plat. 3. Esc. 2. L. Drag. Regt.

6. Each regiment will establish telephone communication within its sub-sectors with its service telephone equipment; other lines of information will be installed by the Reserve Division Telegraph Section pursuant to special orders from this office.
7. I shall take quarters in the Gut at POLZOW, where officers will report to receive orders at 6 P.M. to-morrow.

Copies to.....

A.

SPECIAL MEASURES TO BE TAKEN AT ONCE BY THE COMMANDER.

1. Purchase of wire and tools in Stettin; shipment thereof to Pasewalk.

2. Directions to the Imperial P. O. Department and the River Department at Pasewalk and Prenzlau, as to the use of government telephone lines and equipment in the service of information, according to recommendations therefor submitted by the commander of the Reserve Division Telegraph Section.—Draft of plans for establishing telephone lines.

3. Special arrangements for transmission of information and for scout service on the left bank of the Oder.

4. Directions to the communities along the stream in regard to the collection of boats within their jurisdictions and the discontinuance of ferry service.

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APPENDIX I.

EXPEDIENTS FOR QUICKLY CROSSING STREAMS.

(According to tests made by German Pioneer Companies.)

I. FORDING AND SWIMMING.

A. Fording.

If there are no bridges over a stream and neither boats nor ferries are available, fording is the simplest way of getting across. In war, no troops will be water shy, if necessity for crossing exists. The Pioneer Field Manual gives the maximum practicable depth of water at a ford as 1 m. for infantry and 1.3 m. for cavalry. In all probability, infantry will be able to cross even if the water is much deeper. At any rate, reports from the colonies, where fording is still the usual method of crossing on all expeditions, indicate that troops forded streams with the water reaching up to the men's breasts—or a depth of about 1.2 m., and even up to their mouth. But a ford where the depth of water exceeds 1 m., always presents some difficulties. Even with a current of medium velocity, men who can not swim, become nervous when the upper portion of their bodies feels the pressure of the current.—There are quite a few examples on record in military history of infantry crossing a stream mounted up behind troopers. Napoleon threw some covering infantry across the Beresina in this manner.

It is usually unnecessary to make any special preparations or to mark the ford; all that one needs to do is to follow the wagon tracks. If new fords are discovered on rivers of some width, a few men, preferably good swimmers who have removed their clothing, should be sent ahead to reconnoiter them. The limits of such new fords should be plainly indicated by poles, ropes fastened to posts, anchored floats, etc. If there are large boulders in the water, they should be removed; if the approaches are bad, they should be repaired. (Par. 29, Pioneer Field Manual.)

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It is undesirable to have the men get their clothing wet. If there is ample time, the men should be allowed to undress and to carry their clothing across on their heads or backs. The entire field equipment of an infantryman can be packed in a shelter tent and carried either on the man's head (see Fig. 41) or on his back. (See Fig. 42.) The latter method is used if the ford is shallow. It leaves the man's arms free, which is a considerable advantage if the current is swift.

When properly instructed, untrained men can undress and pack the headload, or unpack it and dress in 8 to 10 minutes. The back load can be packed more quickly.

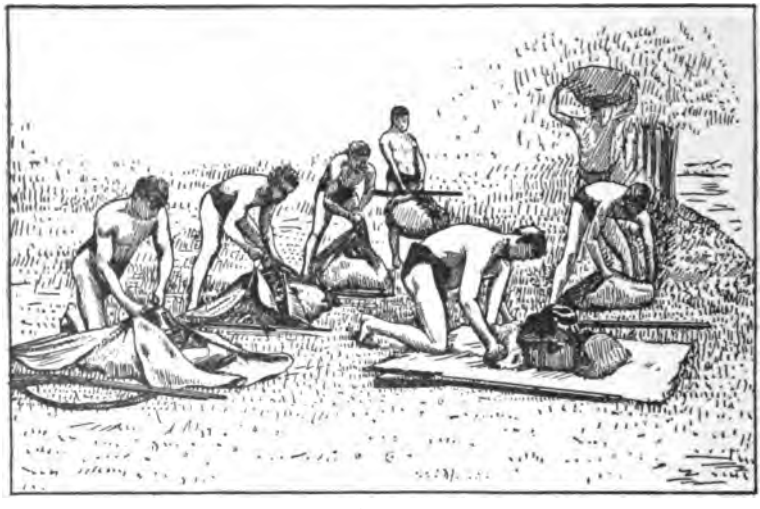

Fig. 41.
Packing the head load

Streams are forded either on a broad front or, in case the ford is subject to variations in depth, in columns of files or twos, between lines of men posted above and below the ford, to break the current and to save men who lose their footing, respectively. If the men close up too much in crossing in column, the force of the current will be increased. If streams are forded with the aid of cables or coupled poles stretched from bank to bank, the men should cross on the down-stream side of such contrivances. If the bottom is rocky or full of sharp stones, the men should wear their barrack shoes.

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The cavalry encounters particular difficulties in fording streams, and of all arms is most often called upon to cross them in that manner. In deep streams the unevenness of the river bed, soft bottom, steep banks, nervousness and helplessness of the horses, the weight of the clothing and equipment, may be a great handicap and seriously endanger both trooper and horse. Every ford that is not thoroughly known or that appears unsafe should, as a general rule, be first tested by a good swimmer (undressed) to see whether the water thereat does not exceed the maximum practicable depth of 1.3 m. The direction as well as the limits of the ford should be indicated by planting lances on the opposite bank, which will assist the troops in keeping the indicated direction. A still better plan consists of posting a few men in prolongation of the ford on the opposite bank with orders to call to the troopers, who ride across in single file, (see par. 477, Pioneer Field Manual) when they deviate from the proper direction. If the water at the ford is more than 1.3 m. deep, or if it is shallower but the bottom is soft, fording will be very dangerous or even impossible. Arrangements will then have to be made to swim across. Whether it is a good plan to hitch a lariat to the leading horse so as to enable the following trooper to pull it back in case it loses bottom, will have to be determined by experiment. In any event, the lariat will have to be kept taut at all times, to prevent the horse from becoming entangled in it. It will frequently be necessary to cut down the banks on both sides of the river and to corduroy them quickly with rushes, brushwood, etc., to make it easier for the horses to enter and to leave the water. Our East-African Colonial troops have had a good deal of experience in fording streams. Their

Fig. 42.
Back load

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Provisional Field Service Regulations recommend that saddle animals be pulled across narrow, very swift streams, by means of long ropes. These ropes should not, however, be fastened to the halter, but around the horse's body, as his head would otherwise be drawn under during the process of crossing.

Fig. 43.
Fording the Weser

If practicable, arrangements should invariably be made in the case of unreliable fords, for safeguarding the troops during the passage.[1] Life-boats and strong cables stretched from

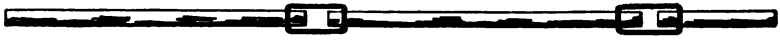

Fig. 44.
Coupled poles

bank to bank below the ford are suitable. Poles lashed together by ropes and stretched across the stream in a similar manner will float and are an excellent substitute for the cables mentioned. (See Fig. 44.)

[1] During peace maneuvers, neutralized bridge wagons of the divisional bridge train with the necessary personnel mounted thereon, can be sent along with the larger cavalry patrols that have to cross streams. These wagons are sufficiently mobile even off the roads for all practical purposes.

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B. Swimming.

The crossing of streams by swimming, forms an important part of the training of our cavalry. The Pioneer Field Manual devotes an entire chapter to the subject. (Pars. 425 and 471–476.) Our military literature is likewise replete with suggestions.[1] An essay written by Lieutenant Count von Preysing[2] contains many valuable suggestions in regard to the training of cavalry in swimming and the practical application of swimming in crossing streams.

It is always difficult to transport the equipment across a stream. The horse can not swim with it. Lieutenant Preysing suggests that if a patrol has to cross a stream, it procure a suitable beam, pack the equipment, saddles, etc., in the water-tight feed sacks,

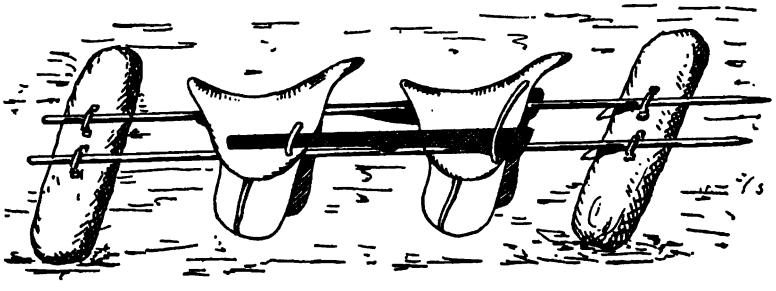

Fig. 45.
Raft of cavalry equipment

and attach these bundles in pairs to the beam. Like the shelter tent bundles, these packed feed sacks will float, and the raft formed by them and the beam can be towed across the stream by a good swimmer. A single trooper can cross in a similar manner, if he packs his equipment as indicated and either has his horse tow the bundle along as it swims across, or tows it himself with a rope after he has gained the opposite bank. It is desirable, of course, that the horse be trained to swim with the stripped saddle.[3]

[1] "Militär-Wochenblatt," 1911, p. 2932.
[2] "Militär-Wochenblatt," 1912, p. 426 et seq.
[3] When Tsheritshev's Cavalry Corps swam across the Elbe on September 16, 1813, part of his Cossacks swam their horses across bareback. "They had packed their equipment, arms, saddles, and booty in small skillfully woven wicker baskets, which they towed along across the river." "Mitteilungen über Gegenstände des Artillerie und Geniewesens," 1913, p. 23.

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The following method of getting saddle, clothing and equipment across is recommended for small patrols (see Fig. 45):

Clothing, saddle pockets, saber boot, mess furniture, and rolled overcoat are wrapped in the saddle blanket and placed in the feed sack. The remaining space is then filled with straw, hay, grass, leaves, rushes, or the like.

Two feed sacks packed in this manner are then fastened together by sticking two lances through the loops on the feed sacks.

The two saddles are laid across the lances and fastened to them by the stirrup straps. The carbines are then attached to the sides of the saddles parallel to the lances. The rafts thus formed are then towed across the stream by a good swimmer.

Good results were obtained with these rafts in crossing streams whose current was slow. In case of swift current, it is advisable to lash two such rafts together by means of a few pieces of timber or lances, so as to prevent their capsizing.

If the cavalry does not employ its service bridge equipage, it can make use of the same expedients, described below, that are used by the infantry.

We might well ask, when will infantry ever have to cross a stream by swimming?

In the first place, patrols may want to cross a stream some distance away from the enemy. In such a case, there will usually be ample time for the men to undress and to transfer their entire equipment, as well as men who can not swim, to the opposite bank, rafts being used for the purpose in the absence of other contrivances. If there is no need of haste, a small unit of such a company may cross in a similar manner.

Besides, it will often be desirable for patrols and other small bodies to withdraw quickly from hostile pursuit during a retreat, when neither boats nor ferries are in readiness for transferring them across the stream. The individual soldier will simply have to swim in such a case to make good his escape. He will, without doubt, quickly remove his boots and even his coat, but endeavor to carry his arms with him. Aids in crossing in such a manner consist either of some substitute for a life preserver, or of floats to which the man can cling and to which he can fasten his weapons and perhaps even a part of his equipment.

Such simple contrivances are still more important when it

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becomes necessary to cross a stream, even a narrow one, in face of the enemy and under his fire. As already stated elsewhere, pontons and hasty bridges are to be utilized when practicable, in such a case. But it is questionable whether one will be able to utilize these in every case, as it will be exceedingly difficult, especially under hostile fire, to carry the pontons and the usually rather heavy hasty bridges to the river. It is therefore doubtful whether one will be able to depend upon them. It would be ideal, indeed, if skirmishers could advance on a broad front to the river and each man could swim across the stream that separates him from the enemy.

It is by no means asking too much of a skirmish line to require it to swim across a narrow stream. The water near the banks of unimproved, narrow water-courses, is usually so shallow as to permit fording for some distance, and it is only in the middle of the channel that swimming will have to be resorted to for a few meters. If the simplest contrivances were available, one should not doubt the feasibility of getting a line of skirmishers across such an obstacle. It would surely be an especially honorable task for a pioneer company, trained as it is in swimming and familiar as it is with the water and with all expedients used on the water, to lead the way for the infantry. To have men swim across is also the best preparation that can be made before using hasty bridges, as it enables one quickly to occupy small supporting points on the opposite bank, under whose cover such bridges can be brought to the stream and laid.

Such simple expedients will likewise assist men who, completely undressed and armed with nothing but light weapons (pistols), or entirely unarmed, swim to the hostile bank for the purpose of reconnoitering preparatory to a general crossing or preparatory to warding off such an enterprise. The same is true of men who have to swim across to do work of one kind or another on the opposite bank—such as measuring the width of the stream, bringing a rope across, etc. The pioneers carry life belts on their wagons for such emergencies.

When infantry has to swim across a stream, it can make use of any of the following expedients:

1. Strong cables stretched from bank to bank;
2. Floats for individual men;
3. Light rafts for transporting equipment and arms.

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1. A cable stretched from bank to bank, or as a substitute, coupled poles (Fig. 44), will enable men who can not swim to cross deep places in a river. A fully clothed man can draw himself across a stream 60 m. wide, by means of such a cable or pole, in about 1½ minutes (Fig. 46). It is not very easy to stretch the cable across a wider stream than this. It is advisable to have a good swimmer take a small rope, to which the cable is

Fig. 46.
Infantryman, fully equipped for field service, pulls himself across on coupled poles

attached, across first, and then have this man pull the cable across. The cable may likewise be fastened to a long coupled pole, which is laid in the water parallel to the bank, and then let the current swing it over to the opposite bank, where the cable end is secured by men that have previously crossed by swimming. (Fig. 47.)

2. *Floats.* But even if such aids are used, it is difficult for

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men to swim across a stream with all their clothing and equipment. Necessity will usually compel one to use such aids. A patrol that is falling back before the enemy to a river may still escape if it can manage to reach points on the bank where it has hidden simple floats to which the men can cling in swimming across the river. If practicable, the men should remove all clothing and equipment that might hamper them in any way. This injunction applies with equal force to men who are required to swim across a stream in making an attack on hostile troops posted on the opposite bank.

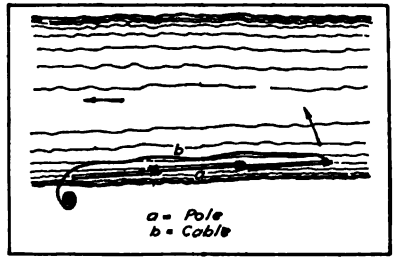

Fig. 47.
Method of getting an anchor cable across a stream

Men who possess more than ordinary boldness, can swim fully equipped across a stream with nothing to aid them but beams, boards, fascines, etc., but their wet clothing and the weight of the drenched knapsacks, overcoats, etc., is so great that considerable performances can not be exacted for any length of time.

In general, ½ cwt. of dry timber will carry a fully clothed man with his rifle and 90 rounds of ammunition. This weight corresponds approximately to a beam 10 × 10 cm. × 2 m.

It is exceedingly dangerous to tie a man to the top of a float, as its buoyancy will tend to turn the man over, thus forcing him under the water. It is far better for the man simply to cling to the float.

If the rifles get wet when the men swim across—and this is very apt to happen, they should not be used until all water that may have gotten into the barrel has been removed. To what an extent the ammunition will stand wetting will have to be determined experimentally. Three or four clips of cartridges can be carried under the helmet, however.

The following contrivances have been found useful as simple floats:

(*a*) Cross pieces are nailed under a beam and boards nailed to them parallel to the beam (Fig. 48). Thongs are then attached to this frame, as also to all the other contrivances to be described

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later on, by means of which equipments and arms may be fastened to it.

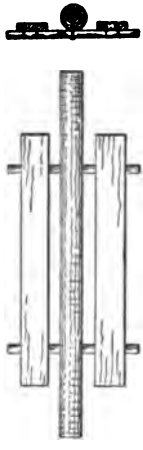

Fig. 48.
Simple balk float

(*b*) Triangular or rectangular frames of beams or boards have less buoyancy and are therefore better adapted for men who have removed their clothing before swimming across. (Figs. 49 and 50.) The buoyancy of the triangular float may be increased by fastening a shelter tent bundle underneath, so that knapsack and rifle may be carried there. (Fig. 51.)

(*c*) A simple circular life preserver may be constructed by buttoning three shelter tents together, piling straw thereon, pulling the sides over the top and fastening them and the ends, thus making a ring. Of course, the canvas of the shelter tents must be water-tight. This ring can be still further improved by buttoning three additional shelter tents in a similar manner across the top so as to cover the opening where the lower tents are fastened.

Whether such rings will be suitable for crossing a stream in case of an attack, still needs to be determined. Fig. 52 shows

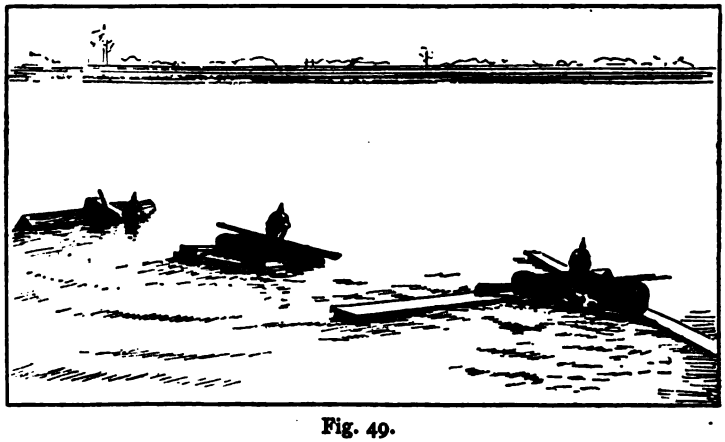

Fig. 49.
Simple rafts

a number of men equipped with the recently tested "Safety" life belts, swimming across a river. The firm that furnished

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these, likewise manufactures floats that enable horses to swim with their complete equipment.

3. *Contrivances for transporting equipment.* If practicable,

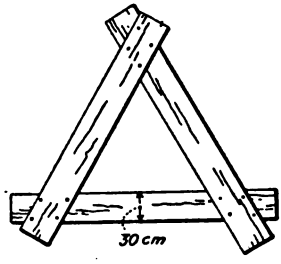

Fig. 50.
Triangular raft of boards

Fig. 51.
Raft of shelter tent bundles

men who swim unassisted or with the aid of contrivances enumerated under 2, should remove all of their clothing. At

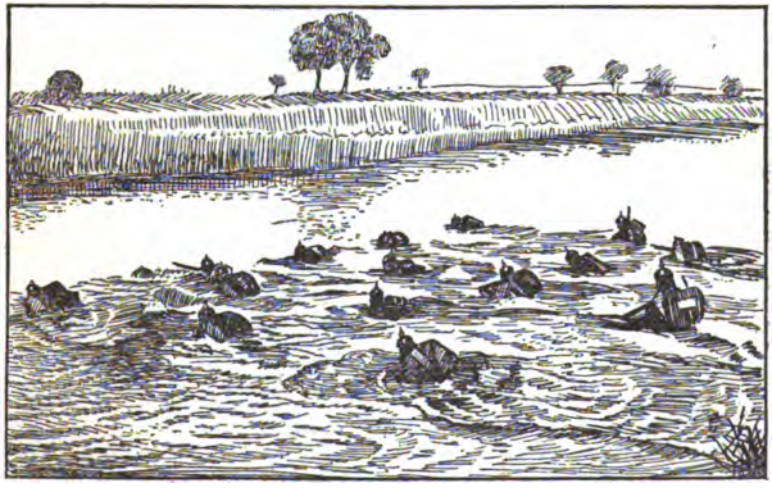

Fig. 52.
Skirmishers equipped with "safety" life belts

most, they should carry nothing but their boots, which they can sling around their necks. If a man carries his knapsack, he

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will be in imminent danger of drowning, in case he uses one of the floats enumerated and it capsizes on account of the unequal distribution of the load. If time admits, arms and equipments should, therefore, invariably be transported on separate floats. The simplest and best contrivance for this purpose is that shown in Fig. 77, Pioneer Field Manual. It consists of a shelter tent bundle in which the entire equipment is packed. This

Fig. 53.
Floating shelter tent bundles

bundle will float even if no other material, such as straw, etc., is packed in it. Soaking the canvas in water, will increase its imperviousness. A swimmer can either tow this bundle by a small string, or push it before him, though the latter requires more effort. (Fig. 53.) A larger float is shown in Fig. 78, Pioneer Field Manual.

Another simple contrivance consists of two pieces of timber over which boards, small poles, or even a section of a strong picket fence are nailed. (Figs. 54 and 55.) This float should not be less than 1 m. wide. The heavier the load it is to carry, the wider the float should be made. Lash ropes should be provided to hold the load in place when the float rocks.

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These floats can likewise be used to transport men who can not swim. When used for this purpose, a stout rope should be attached to the float and the loose end carried across the stream by a good swimmer. The man who can not swim can then cling to the float as he is pulled across. Simple rope ferries may also be constructed out of these floats, provided the stream is not too wide.

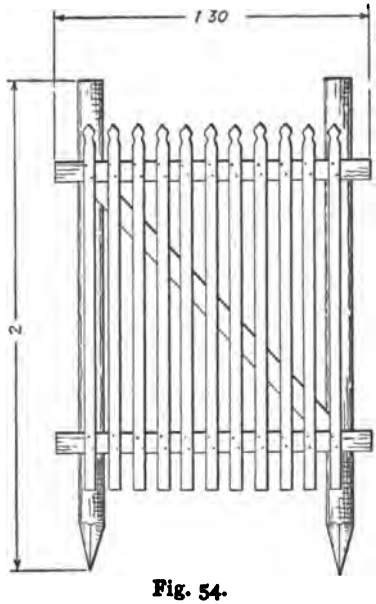

Fig. 54.
Raft of posts and picket fence

II. RAFTS.

There are many ways in which local building materials and contrivances may be used to construct rafts of various sorts, on which men can cross a stream instead of fording or swimming it. The "Kriegstechnische Zeitschrift" of 1899, on page

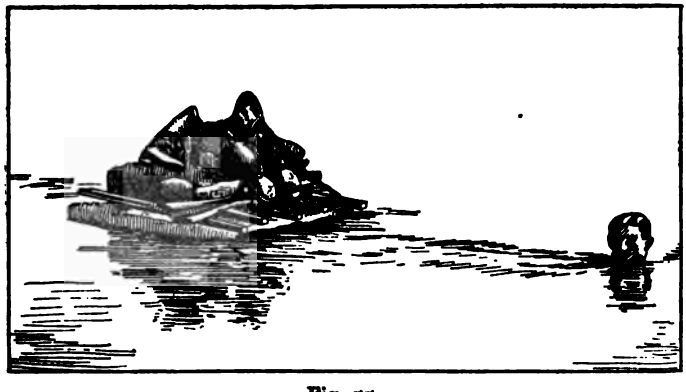

Fig. 55.
Swimmer with a light raft

261, *et seq.*, enumerates a large number of rafts that were tested out in the Russian Army, and paragraphs 153–156, Pioneer Field

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Manual, indicate appropriate methods of construction. Any soldier who is at all practical and resourceful will, in case of necessity, be able to build himself such a raft even if he has not had any special instruction in the subject, provided he is familiar with a few general principles that enter into its construction. If the raft is to be built entirely of wood (timbers or boards), its weight, if dry, should equal the weight of the load it is to carry; if the wood is green, more should be used. The buoyancy of barrels, shelter tent bundles, troughs, etc., must be determined by tests in each case. If practicable, rafts should not be less than 2 m. wide, otherwise they will easily capsize. Narrow rafts should be provided with outriggers, as shown in Fig. 81, Pioneer Field Manual. If narrow rafts are used, two men should get on each, one acting as counter-weight to the other, who either poles or rows it across. The lower the center of gravity of a raft, the greater its stability. Men should, therefore, either sit down or kneel on them.

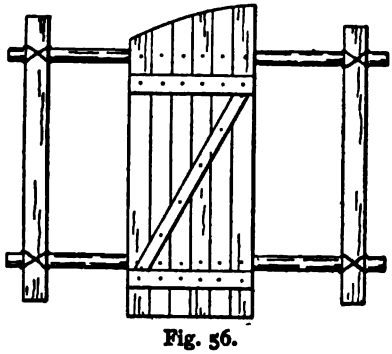

Fig. 56.
Barn door raft

It is not the intention to describe all the contrivances mentioned either in the Pioneer Field Manual or in the "Kriegstechnische Zeitschrift." Part of them are rather complicated, require considerable time to construct, and special tools. Only those will therefore be described that can be built in the minimum time out of easily obtainable materials, and whose very simplicity

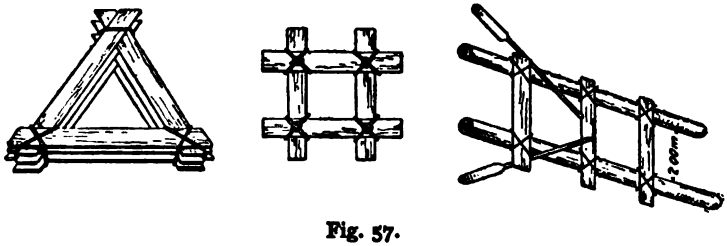

Fig. 57.
Simple rafts made of boards and beams

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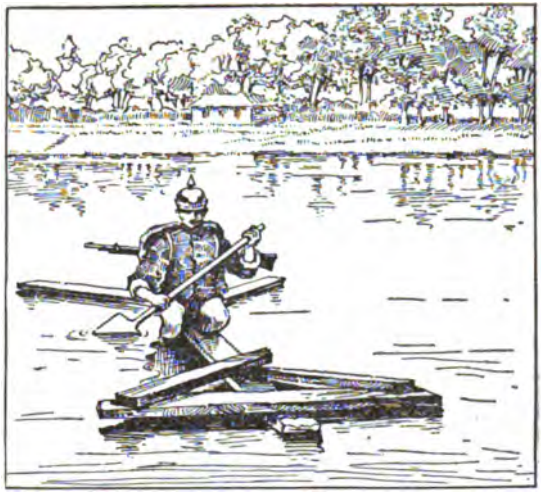

Fig. 58.
Beam with outriggers

Fig. 59.
Fascine raft

makes them desirable. A barn door nailed on long poles and provided with outriggers, will unquestionably be the most easily and most quickly constructed contrivance of this sort, and, though unwieldy, will be suitable for the use of a few men.

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A few simple types of rafts are described on page 263 of the "Kriegstechnische Zeitschrift" of 1899. (See Fig. 57.)

Fig. 58 illustrates the use of a single beam with outriggers 2 m. long.

The raft shown in Fig. 59 is constructed of bundles of brushwood over which boards (or long poles) are lashed. Such a raft can be built if one has to cross at a point far removed from habitations and where nothing but standing timber is available.

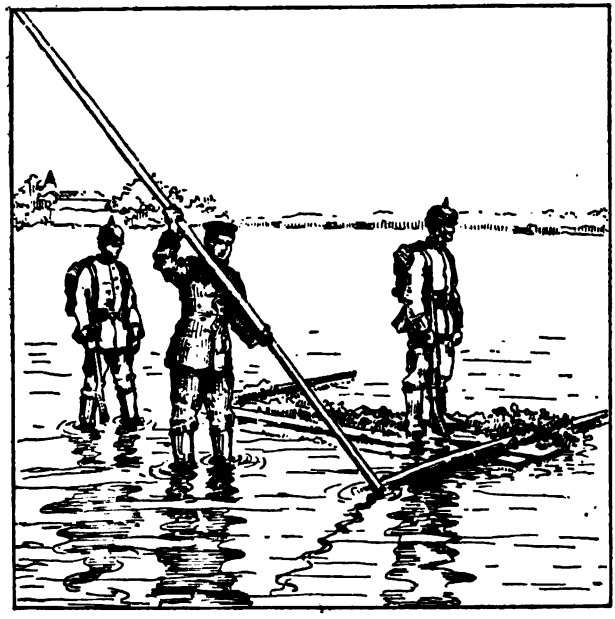

Fig. 60.
Straw raft

A similar raft, which has considerable buoyancy, is shown in Fig. 60. It consists of two layers of boards between which straw or, better yet, rushes have been placed. Poles are lashed across the structure so as to hold the two layers of boards and the straw together.

An apparently very useful raft may be made by taking a barrel and fastening it in a triangular frame of boards. (Fig. 61.) It will probably be a good plan to ballast the barrel with rocks to increase its stability, unless the equipment of several men is carried in it.

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If they are provided with outriggers, even such unreliable vessels as light skiffs can be used for transporting a large number of men across a stream. (Fig. 62.)

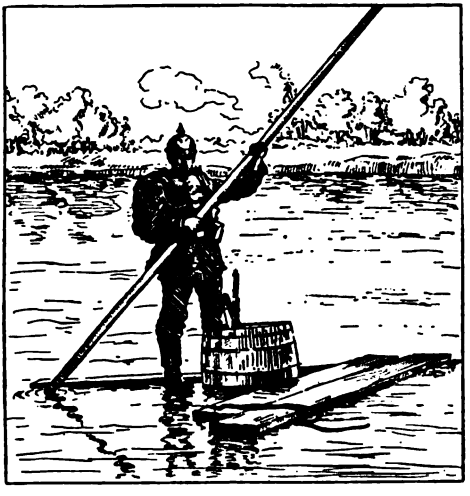

Fig. 61.
Simple barrel raft

Fig. 62.
Skiff with outriggers

Pars. 148, 158 and 159, Pioneer Field Manual, give sufficient information in regard to the larger rafts that infantry will no doubt be obliged to build in exceptional cases.

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III. HASTY BRIDGES.

General.

The term "Hasty Bridges" has, in practice, come to be used to designate foot bridges that are built quickly, frequently as a surprise to the enemy, during an action, or in immediate connection therewith, either following or preceding it. They are to augment or to replace the means primarily used in ferrying, such as pontons and boats, to enable infantry to advance rapidly across streams and thereby to eliminate an obstacle upon whose effectiveness the enemy may, perhaps, have counted. It is by no means to be presumed that such bridges are invariably built within the zone of hostile fire, or perhaps at the very muzzle of the guns of a hostile skirmish line on the opposite bank. Often, however, it is necessary to gain the opposite bank quickly within range of the enemy's fire, before he has time to reach the crossing point to ward off the attempted enterprise.

This distinction should be kept in mind, for it will aid in understanding the conditions under which hasty bridges are built. It is by no means necessary for the attacker to make use of hasty bridges every time hostile fire is directed at him from the opposite bank of the stream he intends to cross. But such fire might force him to build his bridge in the minimum of time and induce him to expose as few men on the bank as possible. In many cases, on the contrary, bridge construction can proceed without hostile interference, there will be ample time available—a factor of considerable importance in case of the wider streams, and a strong force of workmen can expose itself with impunity on the river bank. Before the battle of Wagram, Napoleon directed his pioneers to place portable bridge sections in readiness, so that after the first echelon of covering troops had been thrown across, they could bridge the Stadlau arm of the Danube, which was 120 m. wide and still separated them from the enemy. As the pioneers completed their task in eight minutes, the bridge sections they built must unquestionably be placed in the category of hasty bridges, although they were not put in place under hostile fire. To put hasty bridges into place under lively hostile fire, will, perhaps, be impossible. One will not be able to use hasty bridges in face of the enemy unless one has gained the superiority of fire or unless nothing but a few hostile skirmishers molest the construction work.

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Hasty bridges can, likewise, be used to good advantage to supplement or to replace ferry equipment, by troops that are thrown across narrow streams to cover the bridge construction work. In crossing wide streams, it is a good plan to have the covering troops take hasty bridges along, if secondary river arms or tributaries have to be crossed on the opposite bank.

Hasty bridges will, therefore, occasionally be used in forced and in surprise crossings.

The foot bridges that were built by the Vth Army Corps over the Sauer at the battle of Wörth, or those that were built of ladders and window blinds by the infantry of Goeben's Division during the engagement of Kissingen over the Saale, are good historical examples of the use of hasty bridges. The hasty bridge built by the 1st Fortress Company of the 1st Pioneer Battalion over the wet ditch of Lunette No. 52, during the siege of Strassburg, which enabled the infantry to make the assault, is a good example from siege warfare.

The construction of hasty bridges is an exceedingly interesting phase of pioneer work. It requires efficient reconnaissance work, resourcefulness in making use of all available local material, and close and skillful coöperation with the infantry, under whose protection the foot bridge is quickly placed into position and which must be at hand when that has been accomplished. The use of hasty bridges, moreover, brings the pioneers into the firing line. They will hail with delight any opportunity that enables them, perhaps in a decisive manner, to make the advance of the infantry possible, or at least easier.

But the construction of hasty bridges can not be reserved for the pioneers alone. In many instances and for reasons that need not be enumerated here, pioneers will not be at hand, and the infantry will have to endeavor to build such bridges as best it can in order to get out of a critical situation. The examples cited from the battle of Wörth and the engagement of Kissingen, alone demonstrate the correctness of this assumption. It will happen only too often that the infantry will be ordered as at Kissingen, "to cross the river anywhere, no matter how." Aside from the construction of field intrenchments, the construction of hasty bridges during an action is, therefore, perhaps one of the most important duties the infantry will have to perform in the field of engineering.

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Many types of light foot bridges will be developed, which infantry as well as the other arms, can use to advantage in other situations. Troops posted in rear of a river line require easily constructed bridges in order to maintain communication with their covering detachments on the opposite bank. Such bridges will likewise be very desirable when the billets of the troops are separated by a stream. They will likewise make it easier for the cavalryman to cross streams in that he can let his mount swim across while he himself carries his saddle and other equipment over the bridge.

The type of construction will depend almost entirely upon the material available in the locality. A village will offer quite a different supply of material than a forest in which not a single human habitation is to be found far and wide. If a pioneer company with its bridge train is at hand, quite a satisfactory type of hasty bridge can be built. But if, during an action, a company of infantry encounters even a narrow stream that it can not cross without more ado, flowing through an extensive area whose barrenness is relieved by only a few trees and bushes, it will have to get along with a much more simple and less satisfactory type of bridge. The best types invented in time of peace are worthless if the requisite material for them, such as barrels or boards or both, are not available. It is obvious that it does not suffice for a company to know how to build two or three fixed types. Everything that settlements or the terrain offer in the way of bridge materials must be utilized for such bridges, and one must be familiar with dozens of types of such bridges if one wishes to make good in actual war. That ideal bridges will rarely be built under such conditions goes without saying. But it is, after all, better to cross a poor hasty bridge than not to get across the river at all. In the cold season, moreover, a skirmish line will, no doubt, much rather cross a brook cautiously, one by one, over numerous foot bridges, than wade up to the chest through its icy water.

One should not dispense with the hasty bridge just because its construction leaves much to be desired. Recourse will often have to be had to such a bridge when material for a better one is not available. But it is indispensable that its construction be so thoroughly understood that the most important requirements of reliability and simplicity will be fulfilled as far as practicable.

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The selection of a type of bridge is often influenced by other considerations, however. Infantry will gain nothing, for example, if it has to stand inactive for a long time in a critical situation while the material needed to build what may be a most excellent hasty bridge, is being collected. The infantry would be perfectly satisfied with even a mediocre bridge, provided that enabled it to quickly gain the opposite bank of the stream.

There will be more latitude allowed in the selection of a type of bridge if one has to bridge a stream outside the zone of the enemy's fire. But new difficulties arise, especially in the procurement of materials, if a large number of hasty bridges, instead of but a few, have to be built to enable troops to cross a stream on a broad front, or in case the bridges must be made very strong to allow the passage of masses, perhaps under hostile fire and at night. The width, depth, bottom, and velocity of the stream and the character of its banks, will, moreover, materially influence the choice of a type.

Hasty bridges must be elastic, not too wide and not too heavy, in order that they can be carried to the stream over narrow and uneven roads for long distances, even under hostile fire. Besides, it is very desirable in certain circumstances, to transport such bridges on wagons. The above shows that a great many things must be thought of in evolving types of hasty bridges and that it will not do to be content with but a few.

The best way to arrive at practical results will be to scrutinize our entire Pioneer Field Manual to ascertain to what extent the types described therein are adapted to our use as hasty bridges. But we shall confine our investigation to those types that can be built by infantry as well as by pioneers. Types whose construction demands technical skill, or requires service equipage, fall into the province of the pioneers and will be mentioned here in passing only. It is likewise not our purpose to describe accurately the details of hasty bridge construction. The various practicable types will merely be indicated so as to encourage practical tests, for no one can possibly accomplish anything in this special field except by gaining practical, personal experience. But all practicable, simple types of hasty bridges, built of improvised materials, have been tried out and will be described in the following pages. It may well be possible to improve the

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enumerated types, for it is not claimed that they are perfect, but it would, indeed, be difficult to invent new ones.

Single Span Bridges.

Aside from quickly constructing a passable dam over a water-course, like the one the French infantry built of bales of hay in August, 1813, when they wanted to cross the Nuthe during the engagement at Thyrow, hasty bridges in their simplest form, are single span bridges. This term denotes bridges that are built in one piece and whose ends are supported on the two banks. They can be used only for bridging gaps not more than 12 m. wide. They can later on be reinforced by placing supports under the center. The bridges built over the Sauer during the battle of Wörth are good examples of single span bridges. In these bridges, poles from the hop fields were used as stringers and boards procured nearby served as flooring.

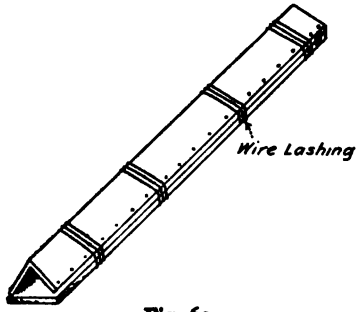

Fig. 63.
Balk made of boards

It is frequently very difficult to procure beams of sufficient strength for use as stringers. A bundle of small poles lashed together by rope or wire can be used in emergencies. A number of such bundles thrown close together over a stream, their ends resting on the banks and staked down to prevent slipping, will form a simple foot bridge that may be classed as a hasty one.

A stringer may be constructed of boards that are long enough to reach from bank to bank, by nailing them together in the form of a triangular beam and then lashing this with wire (Fig. 63).

Fig. 64.
Spliced boards

If the boards are too short to reach across, they may be nailed together and lashed with wire or rope, as shown in Fig. 64. If this work is done at all well, stringers will be secured that

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can be used in case of emergency in building a hasty bridge. A stringer made of boards will be much more reliable if the bridge is constructed as shown in Fig. 65.

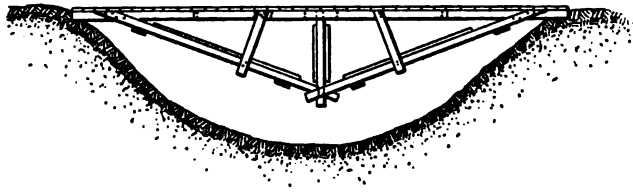

Fig. 65.
Single span bridge made of boards

A single span foot bridge may, likewise, be constructed of long boards joined as indicated in Fig. 64, by nailing one board on top of the edge of the other one, forming a structure having the cross-section of a T (Fig. 66). The perpendicular board is held in place by triangular pieces of wood, which can be fastened to the structure with wire or with strap iron. This simple bridge—whose ends, by the way, should rest on sills on each bank, is

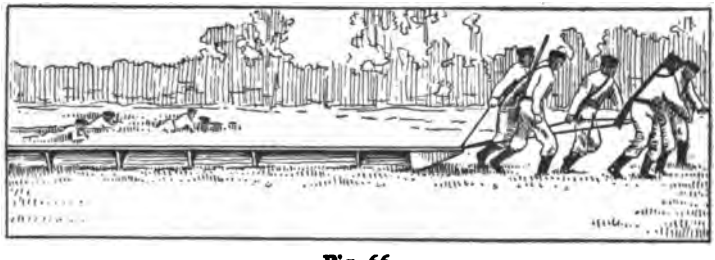

Fig. 66.
Light bridge of boards

Showing details of construction of light bridge of boards

very light. It can easily be dragged along right in the skirmish line, but can not be used to bridge gaps over 12 m. wide.

Longer beams and boards may be used to construct a form of double bow string truss illustrated in Fig. 67. In general, one will probably leave its construction as well as that of suspension bridges, to the pioneers. (Fig. 68.)

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There is something very enticing about using ladders as stringers for foot bridges. Speaking generally, however, they are but poorly suited for this as the side pieces are too much weakened by the rung holes. If used on edge, they make but an indifferent kind of trussed stringer that requires considerable

Fig. 67.
Double bow string truss

bracing in any event. A trussed ladder bridge is illustrated in Fig. 69.

A weak hasty bridge can be materially strengthened by placing perpendicular supports beneath it, thereby shortening the span. Posts of suitable length with a rope fastened to the upper end

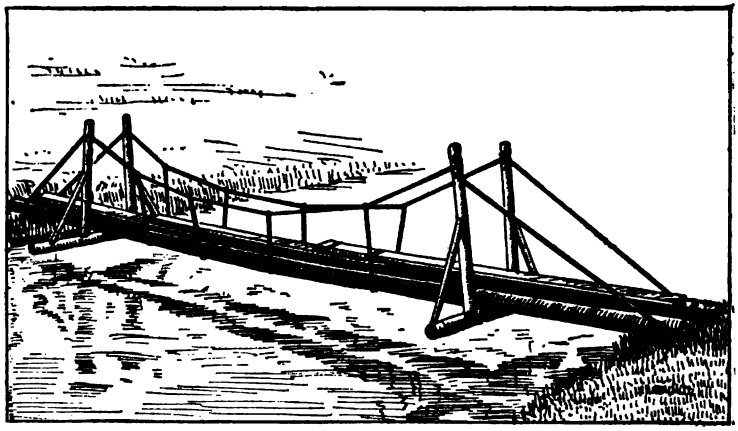

Fig. 68.
Rope cable suspension bridge

make the most satisfactory supports. One man can easily drive them in alongside the stringer. (Fig. 70.) Such supports should be placed in pairs and lashed with a few turns of the attached rope to the stringer, one shore end of the latter being raised during this operation. If necessary, the supports should be braced laterally later on. It will be much easier to attach these

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supports, if the foot bridge has been provided with cross pieces before it is put in place. The trussed ladder bridges mentioned above can likewise be greatly strengthened by piers.

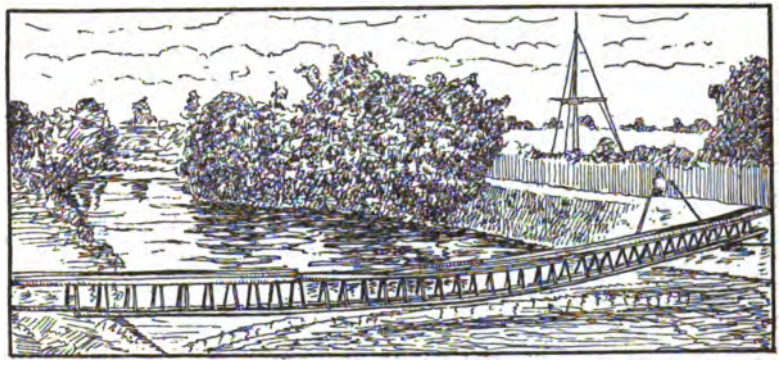

Fig. 69.
Trussed ladder bridge

Short ladders do excellent service as piers. When used for this purpose, they should be placed opposite each other on the sides of the bridge and a board passed over a pair of opposing rungs and under the bridge so as to support it.

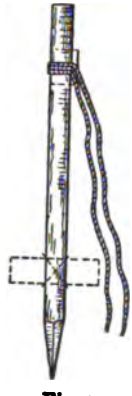

Fig. 70.
Bridge support

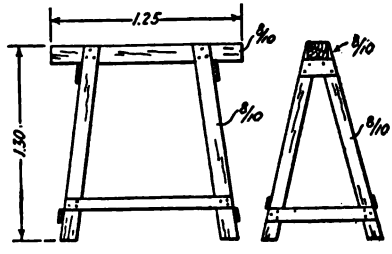

Fig. 71.
Trestle

Weak stringers that reach from bank to bank, can likewise be supported by barrels, boats, inflated bags, shelter tent bundles, doors, bundles of brush, etc. For details, see the chapter on "Floating Piers."

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Fixed Piers.

Single span hasty bridges are to be preferred, but the width of the gap to be bridged often makes it necessary to construct them of a greater number of spans.

This brings up the subject of fixed piers. These are excellent, but are dependent upon the character of the bottom and upon the depth of the stream. To prevent their sinking in soft bottom, mud guards may be attached to them as indicated in Fig. 70. Fixed piers will probably not be useful in water over 1.5 m. deep. The existing local conditions (depth and nature of bottom) must be determined beforehand by reconnaissance. This must be done very carefully, otherwise it will be impossible to make the bridge even. It does not matter much if the bridge is somewhat uneven, however; but there should be no material difference in level, as that would make it not only uncomfortable but dangerous for the troops to cross.

Fig. 72.
Trestle supporting a foot bridge

Light four-legged wooden trestles have been found to make the best piers. (Fig. 71.) They can be easily built by any infantry company, are light, and can be carried along on wagons. They can be put in place by hand in streams not over 1.5 m. deep nor over .6 m. velocity. The superstructure of the bridge can likewise be carried along in sections that overlap when put in place. (Fig. 72.) Rough planks and well made ladders (wagon ladders) have also been used to good advantage. It is desirable to have trestles of various heights at hand so that substitutions can be made in case of emergency.

These trestles do not appear to be simple and practical enough for field use as their construction requires some skill in carpenter work. But their occasional use is nevertheless recommended. Most of the small streams that we are likely to encounter on the march or in action are not over 1.5 m. deep and trestles will be

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invaluable as piers for hasty bridges, provided the bottom of the stream is not too soft. If they are made somewhat stronger and wider, they will likewise be very useful in bridges that are strong enough to allow the passage of the infantry combat train. The trestles are ordinarily put in place by hand, but can be set from the bank or the bridge in the manner shown in Fig. 73.

The use of two-legged spar trestles that must be placed in position by hand is not desirable for hasty bridges. Occasionally, however, such trestles may be put in place in the manner illustrated in Fig. 73. For this purpose, the upper part of the trestle is lashed loosely to the end of the first span of the bridge, and is then shoved into the water until the bottom of the trestle is about in the center of the stream. By pulling on the guide

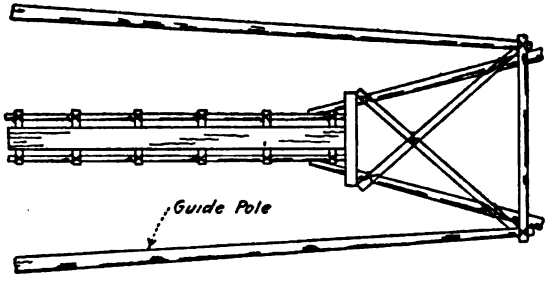

Fig. 73.
Placing trestles in position

poles lashed to it, the trestle is then raised to a perpendicular position. Another complete bridge span is then pushed across to the opposite bank from the trestle, thus closing the remaining gap and completing the bridge. To place a second trestle in position would be too complicated.—This method of construction will, no doubt, be used in exceptional cases only. In the winter time, however, its use would make it possible to build the bridge without the men entering the icy water of the stream.

Wagons and parts of wagons may also be utilized as fixed piers. Wagons can be provided with a suitable frame bearing stringers extending from three to four meters beyond the ends, the stringers being in turn covered with boards.

A wagon so arranged in itself will form a bridge about 12 m. long. (Fig. 74.) It will often suffice to place posts (Fig. 70)

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under the free ends of the stringers, and to connect the center span by short previously prepared bridge spans with the banks.

But the banks must be flat, or at least so low that they can be quickly cut down and the stream bed must descend gradually and be not too uneven, otherwise it will be exceedingly difficult to put wagons in place. All these conditions will rarely be found to exist. It will be somewhat easier to place front or rear parts of wagons into position. But in practice it will be found that

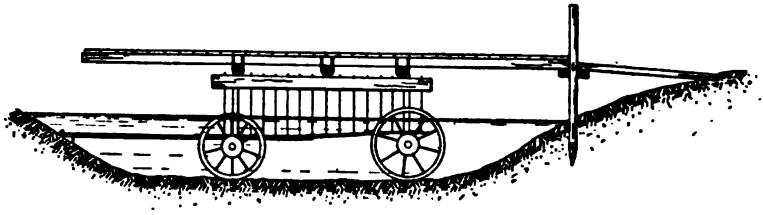

Fig. 74.
Wagon as bridge support

in using them, other difficulties are encountered. They, likewise, will not play much of a rôle in the construction of hasty bridges.

Floating Piers.

The best supports for hasty bridges are floating piers. They are independent of the depth and bottom of the stream, etc., and can be used on wider streams and those having greater velocity (but not exceeding 1 m., or at most 1.5 m. in case of narrow streams).

In a floating bridge, the whole superstructure may rest either directly on the water, or on floating piers. But in either case, such bridges must be rather wide, to increase their stability, as they will otherwise oscillate strongly during the passage of troops and may even capsize entirely. As suitable piers for floating bridges may be mentioned boats, barrels, inflated bags, shelter tent bundles filled with straw, hay, leaves, rushes, etc., water-tight chests, wash troughs, bundles of wood, beams, boards, barn doors, etc. Kitchen boilers placed in shelter tents or in wooden frames have also been tried occasionally as piers. But these have not been found to possess any advantage and troops do not like to part with them. All floating bridges can

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be greatly strengthened by fixed piers, whose use is especially to be recommended in case of long bridges.

Hasty floating bridges can, in the first place, be constructed in one long rigid piece, under which a number of floating piers are lashed. Such bridges, provided steps are taken to prevent oscillation, afford the troops the safest means of crossing. But their use presupposes that the width of the stream has been accurately determined, they are not elastic and can not be transported on wagons.

Another type of hasty floating bridge consists of single or double raft sections that are combined into a bridge at the river. (See Fig. 45, Pioneer Field Manual for an example of this type.) The raft sections must be carefully coupled together, otherwise men will fall in stepping from one to the other, which, on account of its short length and unequal distribution of load, is liable to tip and tilt considerably.

(*a*) *Floating Superstructure.*

In general the buoyancy and stability of a floating superstructure are directly proportional, respectively, to the amount of timber used in it, and to the width of the surface resting upon the water. But there are limits that can not be exceeded, for, if made too heavy the bridge can not be carried forward to the stream and if made too wide, it will be unwieldy and can not be transported through narrow places. One will have to decide in each individual case to what extent one can and must accept the disadvantages of any type. Swift streams of any width can not be bridged at all by such bridges, as they offer too much resistance to the current.

Such bridges will often not be stable enough to permit men to cross except with considerable distances between them, or at a run. But, as has already been pointed out, a poor bridge is better than none at all, and the men should not mind getting their feet wet occasionally in crossing a hasty bridge, so long as they get across to the opposite bank.

If the bridge is built in sections, the coupling, as already stated elsewhere, assumes special importance. The details of coupling bridge sections together, can be learned only by experience. The cross pieces at the extremities of the raft sections are usually lashed together with rope or wire, or coupled with rope loops.

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The flooring of the different sections is often made to overlap, or a separate connecting piece is placed over the junction of adjacent raft sections to eliminate the step. The various coupling devices are illustrated in Figs. 80 and 86 below, as well as in Figs. 44 and 46, Pioneer Field Manual.

Timber rafts as illustrated in Fig. 40, Pioneer Field Manual, make the simplest floating bridges. The oscillations of the bridge can be greatly reduced by fastening long boards here and there as cross pieces under the beams. These boards have the

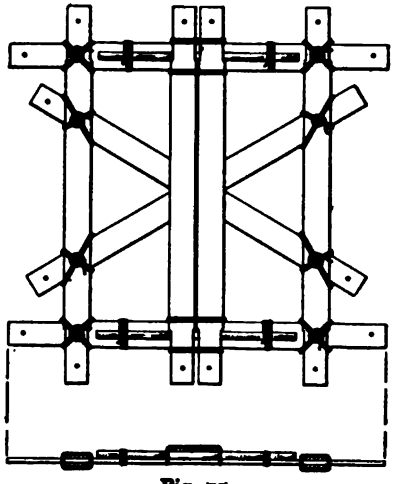

Fig. 75.
Raft section made of chess

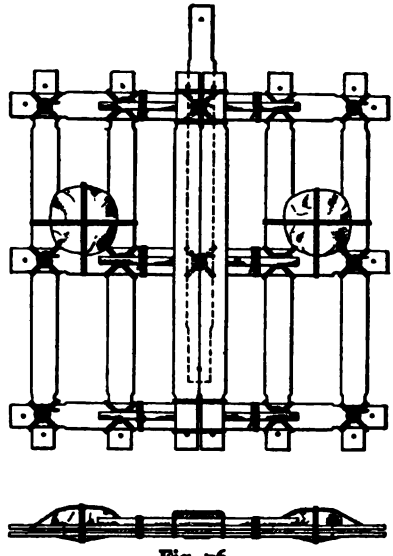

Fig. 76.
Raft section made of chess and shelter tent bundles

same effect as outriggers. Very simple bridges can be built by placing barn doors and boats lengthwise across the stream. The method of anchoring them is indicated in Fig. 41, Pioneer Field Manual, but posts may be used instead as indicated in Fig. 92.

Most of the hasty bridges built of service bridge equipage by the pioneers belong to the class here described. One will have to depend upon them usually in war as they are built of material that is always at the disposal of the troops, provided their commander has seen to it that the bridge trains are brought up in

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time. But it should likewise be remembered that equipage is thereby used up that may later on be needed for building a bridge.

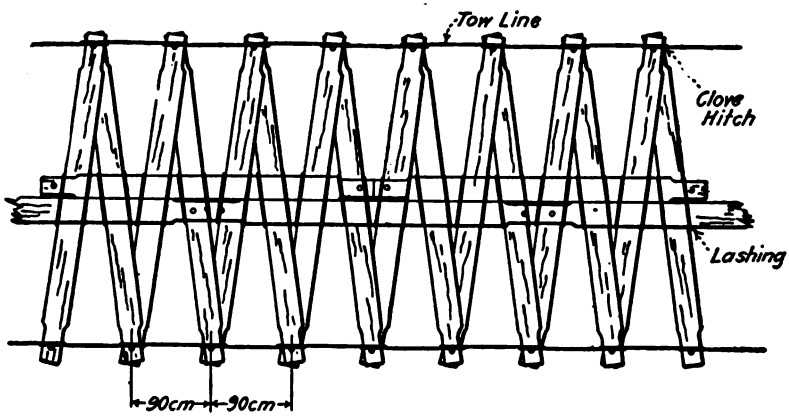

Fig. 77.
Scissor bridge

Figs. 75 and 76 illustrate sections of hasty bridges built of service bridge equipage, but these types can be constructed without special difficulty of improvised material.

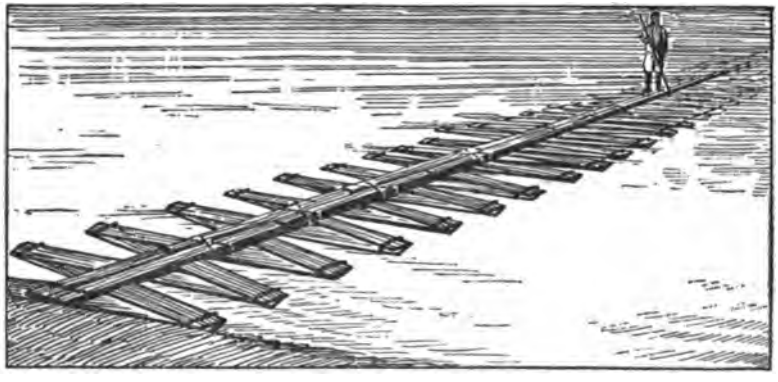

Fig. 78.
Scissor bridge

The scissor bridge illustrated in Figs. 77 and 78 is eminently practical. It consists of boards lashed together as shown in the

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illustration and of two long cables reaching from bank to bank and fastened to the ends of the boards. This bridge is preferably constructed under cover in sections 20 m. long, which are then brought forward and lashed together at the river bank. This type has been tried out up to a length of 100 m. Oscillations are scarcely noticeable in this bridge. Troops cross it in single file, the men following one another at a distance of one meter.

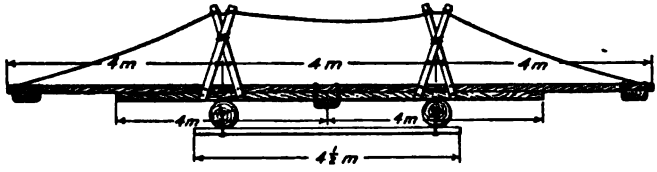

Fig. 79.
Light bridge made of boards

A light foot bridge, which is rather weak but may be made necessary by existing conditions, is shown in Fig. 79. It consists of boards lashed together and on top of one another, reaching from bank to bank and resting upon the water. Long poles are fastened cross-wise underneath as outriggers. Boards nailed

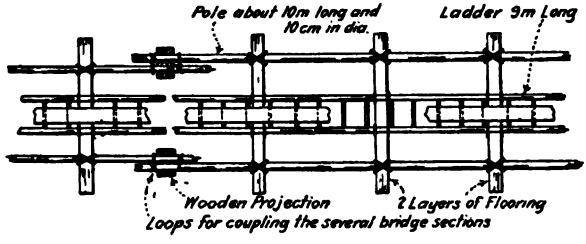

Fig. 80.
Ladder bridge

under these poles are very effective, but must be nailed very securely.

Figs. 80 and 81 illustrate the use of ladders (preferably wagon ladders) in a floating bridge. In Fig. 82 a hasty bridge is shown whose buoyancy has been increased by lashing a barrel (or a shelter tent bundle) with special outriggers to it. Such contrivances are by preference built into a bridge to increase its carrying capacity.

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Fig. 83 illustrates piers consisting of shelter tent bundles fastened on boards to make them less vulnerable. These

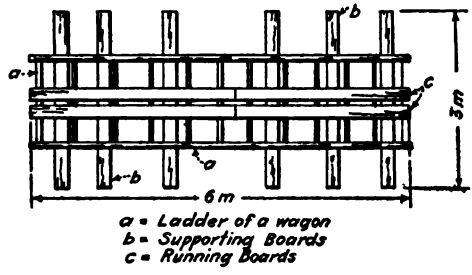

Fig. 81.
Ladder bridge

bundles are made by buttoning two shelter tents together, a third shelter tent being fastened over the junction of the other

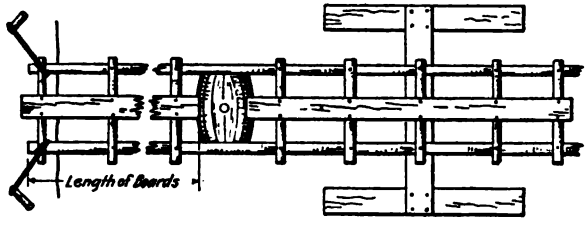

Fig. 82.
Ladder bridge with a barrel built in

two. The tube thus formed is stuffed with straw and the ends tied. Three other shelter tents, similarly fastened together are then placed over the top so as to cover the upper junction.

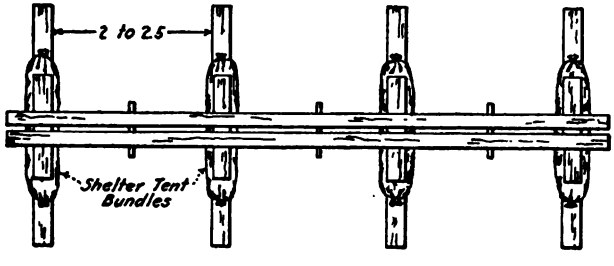

Fig. 83.
Hasty bridge with shelter tent bundles

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In Fig. 84 a large number of shelter tent bundles are laid close together between two strong ladders, preferably wagon ladders. To reduce oscillation, cross pieces of boards are fastened at intervals of several meters underneath the ladders. If two such foot bridges are laid alongside of each other, connected with cross and longitudinal beams and covered with flooring, a bridge will be obtained that will carry horses and vehicles of the combat train.

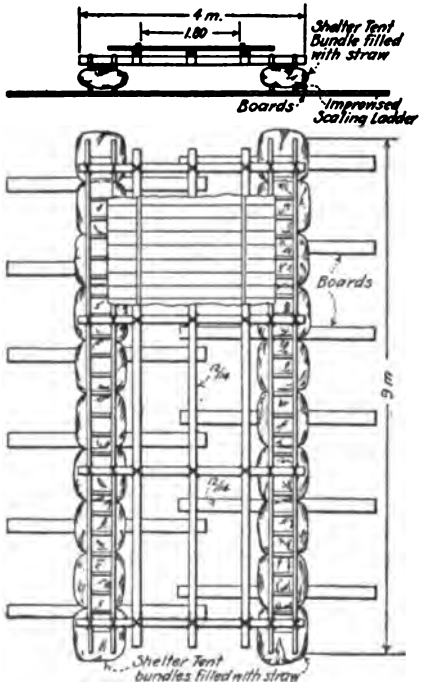

Fig. 84.
Two light foot bridges combined into a bridge

During the American Civil War, light foot bridges were often constructed by felling trees on opposite sides of a stream so their tops would interlace in falling. These trees were then anchored and a crossing cut through the branches. (Fig. 85.)

(*b*) *Hasty Bridges with Special Floating Piers.*

Hasty bridges with special floating piers, in other words, those in which the superstructure itself does not rest upon the water but upon floating piers, are very similar to ponton bridges built of service bridge equipage. They occur at once to any one who attempts to invent practical hasty bridges, and are described in detail in par. 114, Pioneer Field Manual.

Strange as it may seem, little is heard of hasty bridges in which pontons of our bridge trains were used. Most officers, no doubt, imagine that hasty bridges must be of such a character that they can be carried forward by the infantry firing line and put into place under hostile fire. And the heavy pontons, to be sure, are but poorly adapted for that. Yet there are doubtless

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plenty of situations in which these requirements need not be fulfilled at all, where it is only necessary quickly to bridge a stream outside the immediate effective zone of the enemy. It is only necessary to recall the repeatedly mentioned crossing of the Saale at Kissingen. In crossing below that city, the Prussian infantry did not receive a single shot. Had a partially demolished foot bridge not been found there, some type of hasty bridge would, no doubt, have been very acceptable. If a bridge train can be moved unobserved to such a crossing point, what is more natural than to utilize its excellent and handy material for constructing a hasty bridge? Attention has already been called

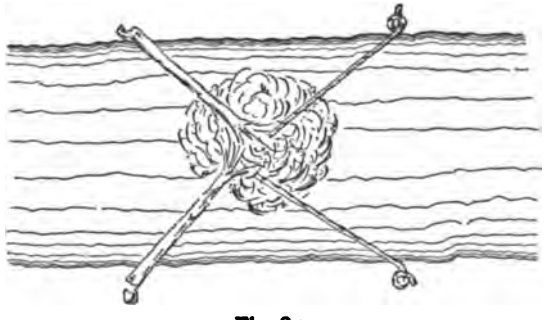

Fig. 85.
Bridge of felled trees

to the advantage of using the balk and chess of the bridge trains in building hasty bridges. The advantage of using pontons as well should, likewise, not be overlooked. Even wide rivers having a strong current can be quickly bridged with them without making extensive and difficult preparations. But their use in such bridges presupposes that the pioneers have had some experience in time of peace in using them for such a purpose. During a field exercise, it took the pioneers only about eight minutes, after making a few preparations under cover, to throw a reliable hasty bridge over a stream 70 m. wide and having a velocity of 1 m. Once such a bridge is completed, troops can unquestionably cross more quickly than by ferrying across in single pontons, which is, after all, the next best course.

Although hasty bridges in which pontons are utilized are scarcely known in our service, such bridges with improvised floating piers are so popular that our companies scarcely practice

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any other construction than that in which barrels and shelter tent bundles are used. Are we not deceiving ourselves as to the value of these bridges in war? Where will we find the necessary barrels? Will the infantry part willingly with its shelter tents in action, without knowing how or when it will ever get them back again? Or, shall the pioneers sacrifice theirs, which were issued for an entirely different purpose and which at best do not suffice for more than a bridge from 30 to 40 m. long, if we assume that the bridge shown in Fig. 45, Pioneer Field Manual, is the type to be constructed? These are doubts that arise in one's mind in contemplating the inordinate preference given to this type of hasty bridge. Nevertheless, it must be admitted that in the combats for possession of the foreground of fortresses or that of fortified field positions, they may do excellent services, particularly because the bundles constructed of shelter tents have the great advantage of losing but little of their buoyancy when perforated by shots. But in the rapid course of a war of maneuver, too much reliance should not be placed on shelter tents.

The types shown in Figs. 44 and 45 Pioneer Field Manual are models that should be followed, as they are especially reliable and excellent. But frequently there will be neither enough material nor enough time for their construction and changes will have to be made to simplify them. The following notes accompany Fig. 44:

(*a*) Shelter tent bundles may be used instead of the barrels shown in the figure.

(*b*) Although the cross and longitudinal braces are desirable to strengthen the bridge and to increase its stability, as many as are shown in Fig. 44 are not absolutely essential.

(*c*) It is sufficient to push one pier under the bridge every 2 m.

(*d*) The hand rail can be replaced by cables held in position alongside the bridge by men.

(*e*) The wider the supports, the greater the stability of the bridge.

The following notes accompany Fig. 45:

(*a*) It is sufficient to use four shelter tent bundles instead of nine as shown in the figure, placed at the corners of each section.

(*b*) Rail and width of a section are governed by the same rules as given in connection with Fig. 44.

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(*c*) The coupling of two sections is particularly important. Coupling consisting of wooden projections and rope loops is the simplest (see Fig. 86). Two sections may likewise be coupled together by a rope loop tightened with a rack stick, unless one prefers to attach ropes to the ends of each section and to fasten the various sections together at the bank.

Aside from the above, the best plan will be to let the pioneers invent changes simplifying the construction and test reliable

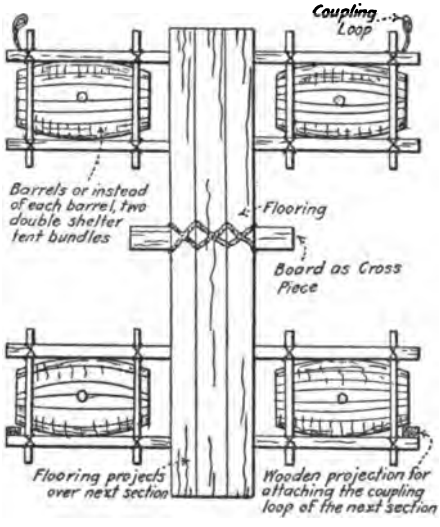

Fig. 86.
Simple bridge section

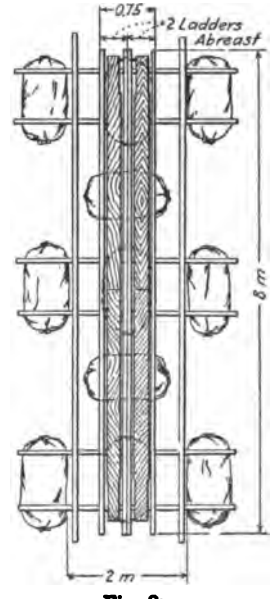

Fig. 87.
Bridge built of ladders and shelter tent bundles

bridges that can be used in crossing wet ditches during assaults in fortress warfare.

Fig. 87 illustrates a simplified type of construction. Singly rolled shelter tents are used. Ladders form the frame work upon which the flooring rests.

A very reliable bridge constructed of barrels that is shown in Fig. 89, will likewise prove useful, particularly in fortress warfare.

To facilitate bringing a hasty bridge composed of floating sections forward by the firing line, the various sections are

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split up into their constituent parts that are not put together until cover is reached on the river bank. (Figs. 90 and 91.) The

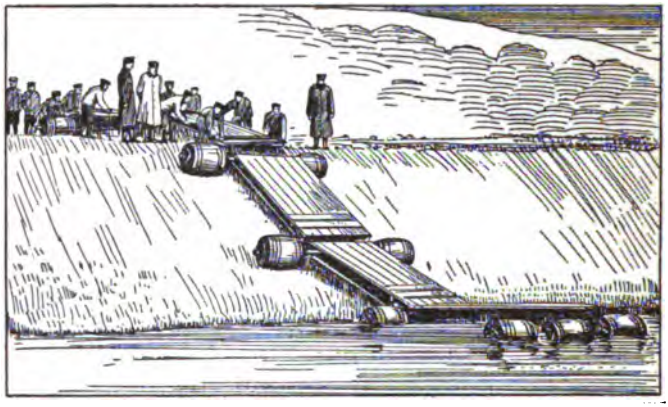

Fig. 88.
Barrel bridge for siege warfare

shelter tent bundles are carried on the back like knapsacks and frames and flooring are dragged by means of ropes by the men.

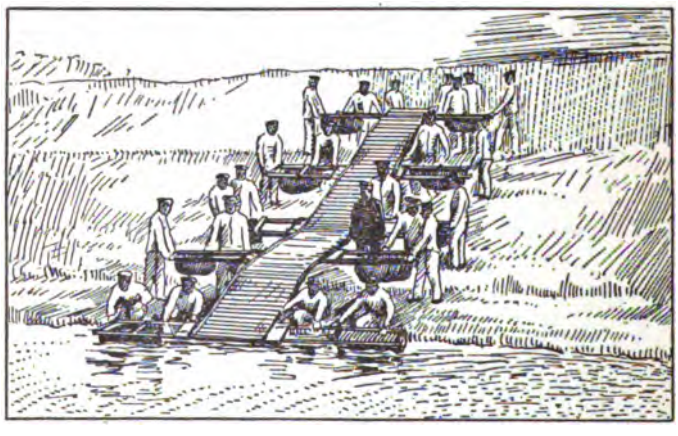

Fig. 89.
Barrel bridge for fortress warfare

But it is doubtful whether any troops other than pioneers will be able to put the sections together quickly and reliably.

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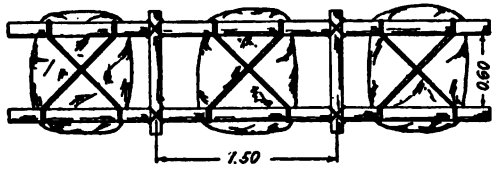

Fig. 90.

Still another kind of floating pier is utilized in hasty bridges. Specially constructed piers are floated into place like boats,

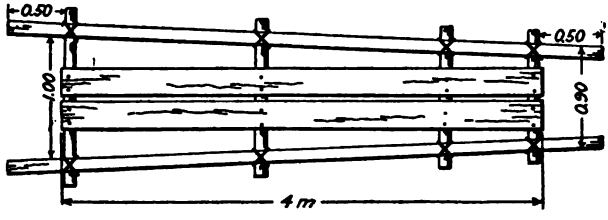

Fig. 91.
Hasty bridge brought forward in sections

anchored in some manner and connected by planks. Fig. 92 shows a type of construction laid down in the Pioneer Field

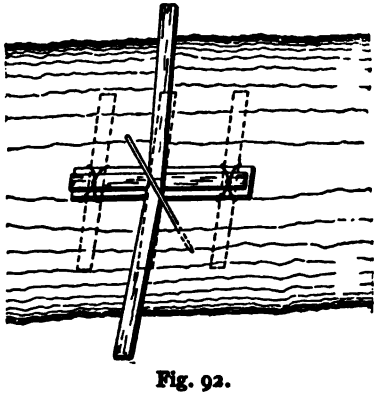

Fig. 92.
Dutch foot bridge

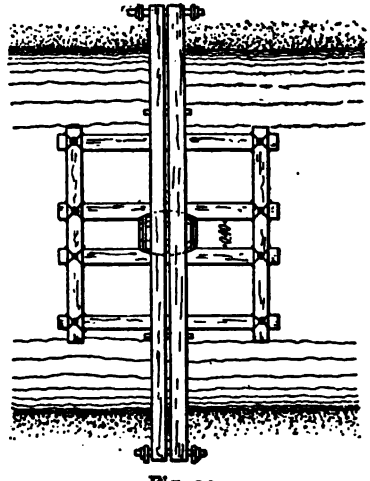

Fig. 93.
Hasty bridge with plank raft as support

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Manual of Holland. A similar type in which a barrel (shelter tent bundle, inflated bag, skiff, bread trough) is utilized is shown in Fig. 93. Green boughs of trees, shelter tent bundles, and boards are utilized in the type illustrated in Fig. 94. Perhaps a

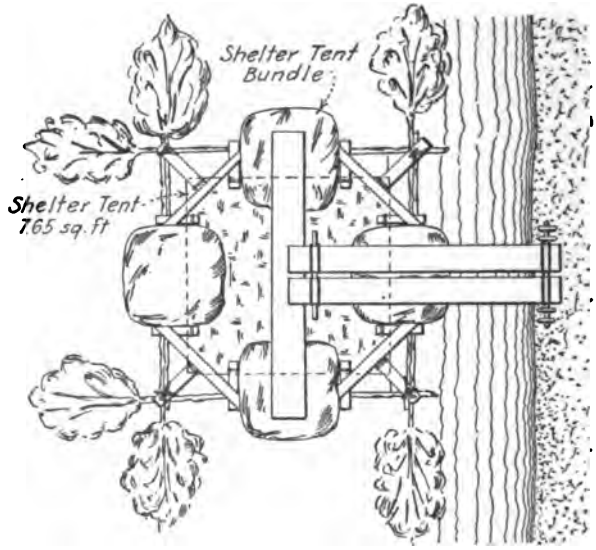

Fig. 94.
Bridge built of boughs of trees and shelter tent bundles

corresponding type of construction will be advisable in case, far from human habitations, no material except that obtainable in a forest is available. In such a case, poles will have to be used as substitutes for boards.

(c) *Hasty Floating Suspension Bridges.*

Another type of bridge that deserves to be mentioned consists of those that may be called hasty floating suspension bridges.

This term denotes light bridges that float in the water, but that get most of their stability by having their extremities firmly anchored to both banks, or better yet, by being pulled taut from both banks. The bridge will then give very little during the passage of troops and will afford a sufficiently secure means of crossing. This method furnishes foot bridges in crossing which the men will undoubtedly get their feet wet, but which

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are extremely easy to construct and to use provided the current is very sluggish. Above all else, however, they make it possible to bridge even wide sheets of water that have no current.

The bridge was at first constructed of service bridge equipage, but can be built without difficulty of improvised material (wire cables, rope cables, boards). Chess from the bridge train are lashed to four anchor cables (in the proportion of about 14 chess to 4 m. — see Fig. 95), a slight interval being left between adjacent chess. In case of a narrow stream, the structure is then pulled across by men who have gained the opposite bank by swimming. In case of wide rivers, the bridge can be swung into position by the current, a few men with poles assisting the movement and dropping a few anchors from the bridge. When the far end of the bridge has reached the opposite bank, the anchor cables are pulled taut on both banks, as above described, by 4 men at each cable end,

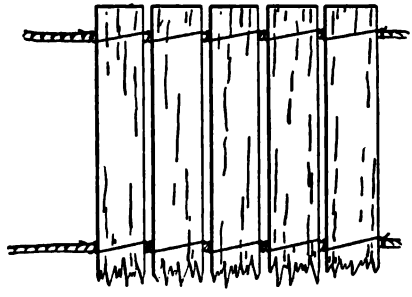

Fig. 95.
Hasty bridge of boards

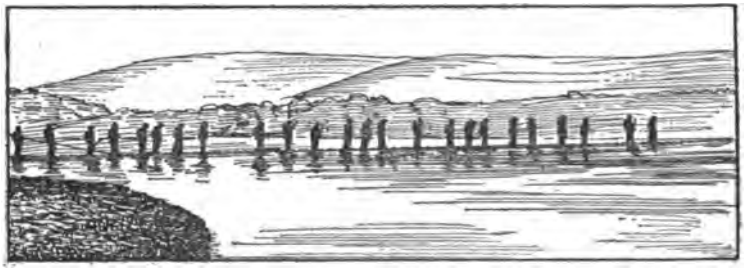

Fig. 96.
Troops crossing the Weser on a bridge made of boards

and the crossing can begin. The bridge furnishes a good crossing even when the stream has a velocity of .6 m., and a width of 80 m. The men should cross in single file with distances of about two paces between them. (See Fig. 96.)

The bridge can be improved by lashing boards across the

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flooring on the down-stream side of the center line of the bridge. —That the men's boots will get wet in crossing can not be avoided. If they were to stand still on the bridge, they might even sink down until the water reaches the calves of their legs. But the principal thing is that one can cross even a wide stream by means of such a bridge, which in a way forms an artificial ford whose disadvantages one gladly accepts provided one can get to the opposite bank.

A great disadvantage of this type of bridge is that it can not well be carried for any distance to the river bank. It is too unwieldy for that. Steep and high banks and strong current reduce its usefulness or nullify it entirely. But it can be quickly

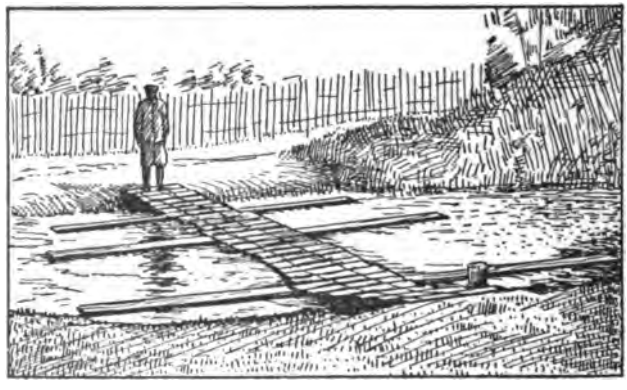

Fig. 97.
Simple board bridge

put together in a nearby village street or forest road and carried forward from there. Provided the men have had some preliminary training, it would likewise be practicable to bring ropes and boards separately to the cover at the river and to put the bridge together there in a very short time.

A bridge of short boards lashed to two long cables (Fig. 97) is still more simple of construction. But it is indispensable that long boards be substituted occasionally for the short ones as outriggers.

If long cables are not available, poles or boards lashed together may be used as substitutes. (See "Kriegstechnische Zeitschrift," 1899, p. 261, et seq.) The usefulness of the type of

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construction requires to be tested. (Figs. 98 and 99.) It will be noticed that no outriggers are used in the bridge shown in Fig. 99.

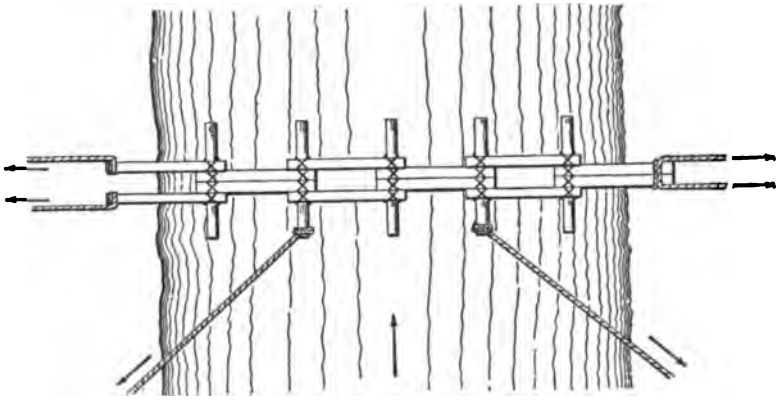

Fig. 98.
Boards used as substitutes for cables

A large number of hasty bridges can be built by infantry very easily and with very little material over streams not exceeding 8 m. in width, in the following manner:

A number of shelter tents are buttoned together so as to form two sheets of canvas that are 2 or 3 m. longer than the stream

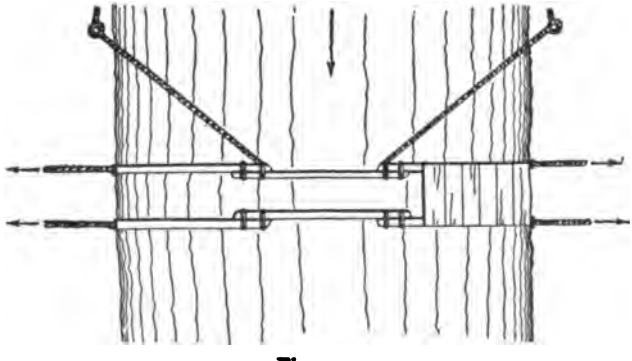

Fig. 99.
Poles used as substitutes for cables

is wide. Stout sticks are laid at intervals of 50 cm. across one of these sheets, and the other placed on top of the first. Both

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are then fastened together, including the sticks, by means of the strings and buttons attached to the shelter tents. The completed structure is then pulled across the stream by a few men and held taut by four men on each bank, so that it will float on the water. If the character of the banks is not too unfavorable men can cross one by one over this bridge by jumping from stick to stick, and although they will probably get wet up to their knees, will be able to gain the opposite bank. The buoyancy of this bridge can be greatly increased by putting sticks having good buoyancy or, better yet, boards between the canvas sheets.

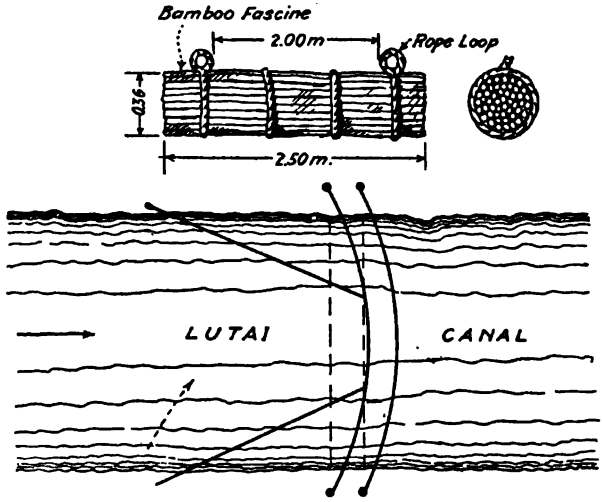

Fig. 100.
Russian hasty bridge built of fascines

Experiments should be made to ascertain whether it would be a good plan to stuff hay, straw or leaves between the sheets in addition to the sticks.

Finally, another type of foot bridge should be mentioned here, that while not used by us, is frequently employed by the Russians and the British. The British use thick fascines (3 m. long, 90 cm. wide, and 45 cm. thick), of rushes or cogon grass, firmly lashed together with strong wire and provided with loops at each lashing. These fascines are placed close together and fastened by means of the loops to strong cables that are stretched across

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the river. The upper surface of the fascines, the gaps between which are closed by inserting smaller fascines, form the floor of the bridge. It is claimed that these floating fascines have great buoyancy and can be crossed by troops in column and even by horses and by light vehicles.

The Russians in a similar manner constructed a bridge 53 m. long and 2 m. wide, of bamboo fascines, over the Lutai Canal at Tientsin during the night 29/30 June, 1900, to enable a turning column to cross. (Fig. 100.) Each fascine used was 2.50 m. long, had a diameter of 36 cm. and could support two men. The lashings were of strong twine and the ones at the ends had loops. The fascines were transported for 16 km., in two-wheeled carts, 12 on each cart, coupled together with poles so as to form rafts 6.4 m. long, and then launched. The various rafts were then coupled together by inserting the poles of adjacent ones through the loops mentioned. After the bridge had been finished near the bank in this manner, and the shore end secured, it was swung across. No additional flooring was provided. The construction consumed 10 minutes.

Hasty Bridges Carried Along As Service Bridge Equipage.

The occasional need of hasty bridges and the difficulty of improvising them, make it obviously desirable permanently to carry along special service hasty bridge equipage. Military journals and reports frequently mention experiments made with such material.

It was at first proposed to return to the old rope suspension bridge, which, built of rope or vines, is the simplest type of foot bridge, and as such, is still held in high esteem in the colonies. Wire cables of light weight but of extraordinary strength, are easily obtainable nowadays, and these combined with bamboo flooring would furnish a very light contrivance that would no doubt bridge any gap not over 24 m. wide.

The Austrian artillery carries along as part of its permanent equipment bridge equipage that is to enable guns to cross quickly over narrow canals and ditches not over 7 m. wide. This consists of a number of iron beams that can be bolted together to form a truss. This, when covered with planking, forms a very reliable bridge.

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The French for a while made experiments with special bridges that were apparently designed to close narrow gaps in demolished bridges. Iron beams fitted with holes at the ends, are bolted together into a truss, which in turn supports the flooring which consists of a sort of wooden screen, which is carried along rolled on a drum. This entire equipment is carried on a rather large wagon. Whether this equipage was finally adopted or not is not known.

The French have in addition adopted floats built after the fashion of those the Russians used at Tientsin. But instead of fascines, the French use water-tight bags stuffed with horse hair and saw dust, or with straw, leaves, etc., and fastened close

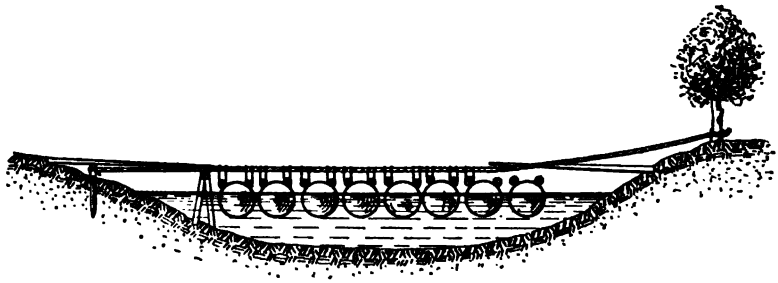

Fig. 101.
French hasty bridge built with canvas sacks

together under cables stretched across a water course. The upper surface of the bags forms the floor of the bridge. (Fig. 101.) The bags are rather large. The Russians are experimenting with the so-called Poljan bags, which are inflated with air. (Fig. 102.) If we adopted them, they would be an excellent substitute for the shelter tent bundles that we use so much in constructing hasty bridges during field exercises, but which in war will, for reasons already stated, scarcely play the rôle that is expected of them. The inflated bags of course lose their buoyancy in case they are struck by a bullet.

The Poljan bags mentioned do not appear to be a part of the prescribed field equipment of the Sapper battalions. Nor can it be determined whether they are carried by other troops. They have apparently been issued to some of the Sapper battalions for experimental purposes and are used by them in their own field exercises and those of all arms.

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One of the Turkestan Sapper battalions has even constructed a special bridge of air bags that is carried in sections on several camels and can be quickly put together. The sections of this bridge can likewise be used as rafts.

One of these air bags is 71 cm. long and when inflated is 27 cm. high, and weighs 1.4 kg. A valve for inflating it is provided. The bag is covered with impregnated canvas, which is to protect it against damage and to serve for attaching necessary leather and rope straps and rings.

According to a Russian technical journal, 240 empty bags can be carried on a single two-wheeled cart.

The inflated bag will carry one cwt. It can be left in the water for 24 hours without losing its buoyancy. If left in the

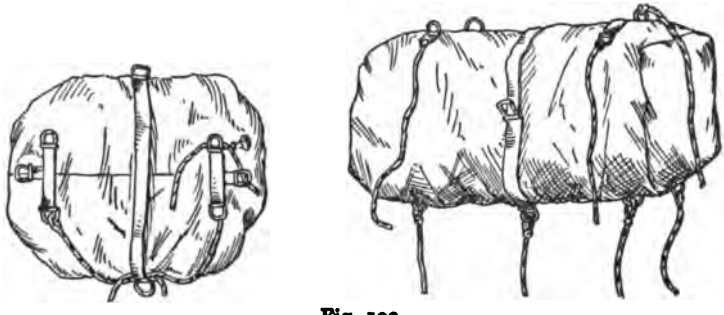

Fig. 102.
Inflated Poljan air bags

water for a longer period, it will lose too much buoyancy because of the gradual escape of the contained air. During the field exercise described below, out of 224 air bags used for nine hours only six lost all their contained air.

Rafts of various types, depending upon the buoyancy desired, may be built of these air bags, for ferrying infantry or guns across a stream. To make a raft, several rows of bags (for example, 7 rows of 16 bags each, or 6 rows of 10 bags each) are placed close together, fastened by means of the straps, and then covered with a flooring of boards.

In order that the buoyancy of the Poljan air bags may be fully appreciated, attention is invited to the following field exercise, in which they were used, although the resulting structure was in no sense a hasty bridge.

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The following results were obtained in crossing the river Om, which was about 70 m. wide and whose current was very sluggish:

240 air bags were available, with which, with the aid of boards and poles carried along, two rafts (each consisting of 7 rows of 16 air bags each) were constructed.

It took one man from 8 to 10 minutes to inflate one bag (after some practice, 3 to 5 minutes).

After the equipment had been placed in readiness and the crossing reconnoitered the previous evening, it took—

½ hour to build the rafts and landing stages;
40 to 50 seconds for 55 men to embark;
20 to 30 seconds for 55 men to disembark;
35 to 40 seconds to load one limber or one gun carriage;
30 to 40 seconds to unload one limber or one gun carriage;
5¼ minutes to load, cross over, and unload, one gun, one gun squad, and 12 to 15 infantrymen, and to return;

The advance guard of the detachment consisted of 9 companies of infantry, each 90–100 men strong, 4 guns, and 2 machine guns, and crossed the river in 40 minutes.

In all one brigade (8 bns) 1 sotnia of Cossacks, 1 battalion of artillery and 1 machine gun battery were ferried across, the horses wimming across elsewhere.

One Sapper company at peace strength was attached to the detachment.

The adoption of water tight canvas sacks as supports for hasty bridges has occasionally been favored in our service. It was proposed to carry these along permanently as part of the field equipment of the pioneers as substitutes for shelter tents in the construction of shelter tent bundles. Experiments were made with sacks 4.5 m. long, 50 cm. in diameter and filled with straw, leaves, etc. They were placed either lengthwise or crosswise under wooden frames that supported the bridge floor. (Fig. 103.) The various sections could be fastened together by rope loops tightened with rack sticks.

The hasty bridges built with this equipment did excellent service. During the Imperial Maneuvers of 1912, three brigades of infantry crossed the Elster on them without accident. The Elster was at that time 20 m. wide, 2 m. deep and its current had a velocity of 1.2 m.

The raft sacks of our pioneers can not be used as piers for

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hasty bridges because not enough of them are carried in the equipment, unless they are used in the manner indicated in Fig. 93. As their name indicates, they are to be used primarily in constructing rafts.

It would, finally, be desirable for troops to carry light boats along permanently, as they would greatly facilitate the construction of hasty bridges. Such boats would likewise be available for reconnaissance purposes. The French have made experiments with boats consisting of wagon covers stretched over wooden frames. The frames carried by each infantry company are 2.65 m. long, 1.30 m. wide, and .6 m. deep and can be taken apart and packed in the company wagon. It is reported that one of these boats will carry ten fully equipped infantrymen. It weighs only 78 kg. A foot bridge 32 m. long, or a normal bridge 16 m. long can be built of the twelve boats carried by a regiment.

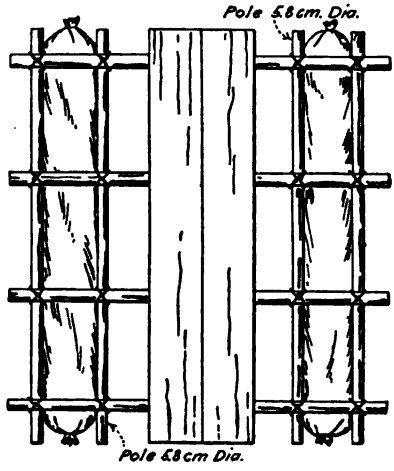

Fig. 103.
Section of hasty bridge with prepared canvas tubes

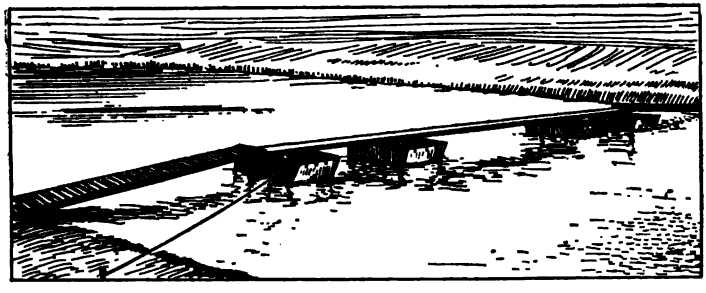

Fig. 104.
Collapsible boats used in a hasty bridge

The results of the tests made with these collapsible boats are said to have been entirely satisfactory.

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The light collapsible boats recently tried out in our own service are of very similar construction. (Fig. 104.) They are 2 m. long, .8 m. wide, .4 m. deep and weigh only 24 kg. If each pioneer company were equipped with 12 such boats, it could quickly build foot bridges not exceeding 39 m. in length, provided the necessary boards were requisitioned for the flooring. Besides, this equipment is so light that it can easily be transported on pack animals, and could be utilized in reconnaissance and in keeping up patrol service over a river.

Other Lessons from Experience.

Just a word or two about the practical side of hasty bridge construction.

Nothing but the very best obtainable material should be selected for hasty bridges and the workmanship put into them should leave absolutely nothing to be desired in the way of care and reliability. Such bridges are frequently composed of sections that are very unwieldy and have to undergo considerable strain in transportation to the river and in launching. Once a bridge is built of them, the troops will naturally want to use it to full capacity. A break may have incalculable consequences as such bridges are not easily repaired, as a rule. Aside from good timber, the bridge should be securely nailed and strong rope and wire should be used in the lashings. All these means are frequently used in combination.

Hasty bridges can be quickly built over a stream without making considerable preparations, provided the men building them do not hesitate to go into the water. That men will often have to swim a stream in order to pull a hasty bridge across, has already been mentioned. But there are other cases in which men will have to work in the water, for example, in temporarily replacing a defective support, or in putting a new one in position.

A hasty bridge will usually first be launched and then either pushed or poled across. Frequently, it may be desirable, as already stated elsewhere, to pull it across with a rope, or to let the current swing it into position. Ropes attached to the bridge as indicated in Fig. 41, Pioneer Field Manual, are very important in placing hasty bridges into position.

It is very desirable after the bridge is in place, to have a few boards on hand to improve the frequently deficient shore ends.

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Besides, a few extra posts like those shown in Fig. 70 should be kept on hand in case extra supports are needed anywhere under the bridge. A hand rail is highly desirable, but is difficult to attach to a hasty bridge and must be replaced by something else. The best substitute consists of poles or ropes held in place, breast high, along the sides of the bridge by men stationed on the banks.

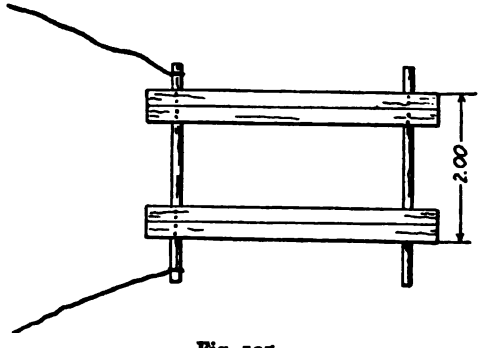

Fig. 105.
Frame for use in a hasty bridge

If the bank is covered with rushes or brush, some difficulty may be experienced in launching the bridge without damaging it. In such a case, it is a good plan to use the device illustrated in Fig. 105, with which the rushes or the brush may be pushed aside. The bridge can then be pushed into the water by sliding it over the contrivance.

But the best training in constructing all kinds of improvised means will be of no avail, if one arrives empty handed at a stream. Without a few tools and some improvised material even the most efficient unit will be able to accomplish nothing reliable. If we assume that infantry may be thrown on its own resources in the difficult situations described and should not wait until the pioneers come to its assistance, it should, in addition to the portable spade and pick mattock be equipped with other tools. There certainly will always be room enough on the wagons of the combat train for a simple saw, some wire, a few strong ropes, and a package of nails. Unless the company commander takes care that these are provided, all the practice he has had in time of peace in bridging streams with improvised means will have been wasted.

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APPENDIX II.

BRIDGE TRAINS OF VARIOUS ARMIES AND THEIR CAPACITY; TIME REQUIRED TO BUILD IMPROVISED BRIDGES.

GERMANY.

Service Bridge Equipage.

I. Each army corps has two divisional and one corps bridge trains available. Each reserve division has one reserve divisional bridge train. Besides, each cavalry regiment has some cavalry bridge equipage.

The bridge constructed with the matériel carried on these bridge trains is strong enough to allow the passage of any load in a field army or siege train. The normal bridge must be reinforced, however, for the passage of the 21 cm. howitzer and the light 15 cm. gun and all wagons weighing more than 3200 kg.

The pontoons have been tested up to 8000 kg., which load leaves 9 cm. free-board.

The cavalry equipage is suitable only for constructing foot bridges and reinforced light bridges.

II. The divisional bridge train (21 wagons, about 75 men and 100 horses), suffices for a bridge 35 m. long. For additional information see IV–VIII. One pioneer company operates it. Its road space is 380 m. It is always enumerated in the distribution of troops of field orders governing billets or marches. If it is contemplated to build a bridge, the whole or a part of the train marches with the pioneer company. If its use is not contemplated, it is temporarily attached to the field train of the troops or to the divisional trains. It is usually advisable to have at least a few bridge wagons of the bridge train march with the pioneer company so as to be at hand for bridging narrow ditches or for reconnoitering streams.

The train, which is almost as mobile as a field battery, consists of 1 trestle balk, 2 trestle, 12 ponton, 2 forage, 1 tool, 1 store, 1 baggage, and 1 ration wagons. Each ponton wagon carries,

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in addition to ½ span of flooring, 1 half-ponton weighing about 300 kg., and requiring 8 men for carrying it. Two half-pontons can be combined into a complete ponton, but the half-pontons may be used to ferry patrols across a stream and to support a foot bridge.

The transportation of men and baggage on divisional bridge trains was discussed in the early part of this work.

III. The corps bridge train consists of 39 wagons, about 200 men and 240 horses and of enough matériel for a bridge 130 m. long. For further details see IV–VIII. This train constitutes an independent unit and marches, as a rule, with one of the supply echelons. Its road space is 860 m. A pioneer escort of approximately 2 officers and 60 men is attached to it, being included in the figures given above. If the equipage of this train is to be used for ferrying or for bridging a stream, at least one pioneer company must be assigned to do the work.

The train consists of 2 trestle wagons, 26 ponton wagons, each carrying one complete ponton, weighing 500 kg., and 11 other wagons. Eighteen men are required to carry a ponton. The train has somewhat less mobility than the divisional bridge train.

IV. *Ferrying.* A complete ponton (or 2 coupled half-pontons) can transport 18 men in addition to the crew. A ponton can be unloaded, manned, and made ready for ferrying in about 3 minutes, provided the men have been properly disposed beforehand.

If two pontons are coupled together into a ferry, the following can be transported:

60 infantrymen, or

6–7 troopers with their horses, or

1 machine gun with its team and gun squad, or

1 field gun with 3 horses and gun squad, or

1 gun of the heavy field artillery with gun squad (or 6 men and 6 horses).

If the ferry is reinforced, heavy carriages of any kind may be transported on it.

Counting from the moment a train arrives at the river bank, a ferry can be loaded with horses, etc., provided ramps and a sufficient number of men are available, and made ready to start in about 30 minutes.

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V. With complete pontons and in a single trip—

1 divisional bridge train can ferry about 100 men across a stream;

1 corps bridge train can ferry about 450 men across a stream; and the whole train of an army corps can ferry about three companies of infantry across a stream.

VI. Ferry equipment required to carry complete units across a stream. (The divisional bridge train carries 12 half = 6 complete pontons = 3 ferries; the corps bridge train carries 26 complete pontons = 12 ferries and 2 life saving pontons.)

	Number required of single pontons	ferries
For one company of infantry	14	4
" " " " " and 1 horse	—	4
" " " " " with combat train	—	6
" " battalion of infantry	56	16
" " " " " with its horses	—	17
" " " " " with combat train	—	25
" " machine gun company	—	9
" " " " " with combat train	—	9
" " machine gun battery	—	12
" " " " " with combat train	—	14
" " escadron	—	23
" " " with combat train	—	25
" " field battery without its reserve	—	10
" " " " with its reserve	—	19
" " " " with combat train	—	23

Example Illustrating the Use of the Above Table:

(*a*) A battalion of infantry (without its horses) is to be ferried across a stream in complete pontons of the divisional bridge train: 56/6 = 9 to 10 trips are required.

(*b*) An escadron is to be ferried across with the equipment of half a corps bridge train: 23/6 = 4 trips are required.

VII. *Duration of Ferry Trips.* If everything goes without a hitch, a ponton can be fully manned in about 2 minutes, 50 m. of water can be covered in about 1 minute, and the landing and disembarkation will take about 2 minutes.

According to tests made in time of peace, in broad daylight, one trip with complete pontons (i. e., embarkation, passage, disembarkation, upstream trip with empty pontons to enable them to reach the starting place, and the return trip across the stream) will consume the following time:

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Width of stream in m.	Velocity of current in seconds per m.	Duration of one trip in minutes
100	1–1.5	10–15
200	1–1.5	about 20
300–400	1–1.5	" 30
300–400	2	" 40

In ferrying during a dark night, about 25 per cent. more time must be reckoned for each trip.

VIII. *Bridge construction.*[1]

Bridge trains	Length of bridge			Time required for construction, hours[3]	Pioneer companies required
	Light bridge, m.	Normal bridge, m.	Heavy bridge, m.		
1 divisional bridge train..	60[2]	35[2]	20	½–1	⅓–1
1 corps bridge train	170	130	75	3	1–2

If the enemy is at a distance and the service bridge equipage is at hand, though not unloaded, a stream 200–300 m. wide can be bridged with it in about 5 hours in broad daylight. If the stream is from 300–400 m. wide, it will take 6 hours. If the bridge is built at night, 50 per cent. more time will be required. The number of pioneers and the time required for the construction proper are merely a general estimate. An approximately correct estimate in the premises can be made in each case only by the pioneer officer directing the construction work.

[1] According to par. 166, Pioneer Field Manual.—Light Bridges are designed for the crossing of infantry in column of files or twos, of cavalry in single file, and, in exceptional cases, of guns without teams (carriage and limber usually crossing separately), of machine guns and of light carriages. Normal bridges are designed for the orderly passage of the field army, exclusive of 21 cm. howitzers and army supply columns. Heavy bridges are designed for the passage of heavy siege guns, troops in mass, and army supply columns.

[2] The figures can be increased not to exceed 20 percent provided some improvised material, especially boards, is requisitioned.

[3] Provided the enemy does not molest the work.

Note: The following terms used in the original, have been rendered as follows:

1. "Brückensteg" by foot bridge;
2. "Laufbrücke" by light bridge;
3. "Behelfsbrücke" by improvised bridge;
4. "Schnellbrücke" by hasty bridge;
5. "Kolonnenbrücke" by normal bridge;
6. "Schwere Kolonnenbrücke" by heavy bridge.

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IX. *Cavalry Bridge Equipage.* This consists of four half-pontons (weighing about 155 kg. each) that can be coupled together to form two complete pontons. This equipment is carried on two bridge wagons. A complete cavalry ponton can carry 10 men or 8 men with their equipment and saddles. The ferry that can be formed by coupling the two pontons of the cavalry regiment together, will carry 30 infantrymen, or four horses, or 50 saddles, or one gun.

The bridge equipage of a cavalry regiment suffices for the construction of a foot bridge 20–32 m. long, or a light bridge 12 m. long, or a reinforced light bridge (3 m. wide) 8 m. long. The latter is strong enough to allow the passage of infantry in route column, with double the normal distance between ranks, of dismounted cavalry in single file, of field guns, of machine guns and of combat trains (limbers, gun carriages and caisson bodies crossing separately with a distance of 10 paces between them).

A cavalry division (3 brigades) can build a reinforced light bridge 52 m. long with the service equipage at its disposal, and, if improvised supports are utilized, the length of this bridge can be increased to 64 m. If one or more divisional bridge trains are attached to a cavalry division, each carrying 60 pioneers in addition to its ordinary load, the division can bridge even wider streams and avoid crossing the stream by swimming. But if the current is swift, such bridges might not be safe enough to allow the passage of troops.

Bridge Construction with Improvised Material. Time Required.[1]

Short Improvised Hasty Bridges.

On August 13, 1870, the 2d Field Company of the Ist Army Corps built a normal bridge 16 m. long and 4 m. wide, over the French Nied. Maximum depth of stream 3 m., one pier; time of construction, 4 hours.

[1] In practice, in time of peace, one usually figures the construction of a heavy bridge of improvised material at 1–2 lineal m. per hour, of a normal bridge at 5–10 lineal m. per hour. In both cases, this includes the procurement of building material, unless that encounters unusual difficulties. The number of men employed appears to exercise a less decisive influence on the time of construction of an improvised bridge than on that of a bridge built of service equipment.—The examples cited from military history are absolutely normal performances. Even if the training were more extensive in time of peace, the time of construction could not be reduced materially except in cases where it is very easy to procure materials.

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On August 16/17, 1870, the Ponton Company of the Vth Army Corps built a heavy bridge about 25 m. long, 7 m. wide, and 7 m. high, over the Moselle at Flavigny on the remains of a demolished bridge truss. Time of construction, 23 hours.

On October 4/5, 1870, the 1st Field Pioneer Company of the IVth Army Corps built a heavy bridge 25 m. long, 4 m. wide, at Beaumont, out of the ruins of a demolished road bridge. Three trestles 7 m. high were used. Time of construction, 20 hours.

Long Improvised Bridges.

On August 9th, 1870, the 2d Field Pioneer Company of the Xth Army Corps, assisted by parts of the 1st and 3d Field Pioneer Companies of that corps, built a normal bridge 45 m. long over the Saar at Saargemünd. Maximum depth of water, 3 m., height of roadway over the water, 1.9 m.; time of construction, 12 hours.

On August 1, 1870, the 1st Field Pioneer Company, of the VIIth Army Corps, built a normal bridge 102 m. long over the Moselle at Schweich. The preparations for this work had been made on July 31st. Maximum depth of water, 1.18 m. 15 piers had to be used. Time of construction 11½ hours.

Between September 18 and 20, 1870, the 4th Field Génie Company of the Bavarian IId Army Corps built a normal bridge 119 m. long and 4 m. wide over the Seine. Time of construction 55 hours. Construction was materially retarded by the difficulty of obtaining materials.

BRIDGE EQUIPAGE OF OTHER ARMIES.

England.

Each of the two field pioneer companies of a division has 2 ponton wagons and 1 trestle wagon, which march with the combat train. A bridge 18(24) m. long can be built of this matériel. The pioneer companies of a division have therefore enough matériel to build a bridge 36(48) m. long.

A bridge train is in addition attached to every two divisions. This consists of 32 ponton wagons and 8 trestle wagons, and suffices for building a bridge 200 m. long.

Each cavalry brigade has a pioneer detachment which has 2 collapsible boats carried on 1 wagon. Steel pontons are being tried out.

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France.

The French infantry division and the reserve division each have one pioneer company, which is equipped with only 5 raft sacks for ferrying patrols across streams. In each of these companies only one-third of the men are trained in ponton work.

The French army corps has a corps bridge train capable of bridging a maximum gap of 128 m. It is operated by one pioneer company, two-thirds of whose men consist of pontoniers and one-third of sappers.

Each army has in addition an army bridge train capable of bridging a gap 256 m. long.

A cavalry division has a pioneer detachment on wheels and equipped with 9 raft sacks. Each cavalry regiment has the Veyry bridge equipage which consists of 4 collapsible steel pontons with the necessary flooring. Its capacity is about equal to that of our cavalry equipage.

Italy.

Each division has a bridge section of 6 bridge wagons, capable of building a bridge approximately 40 m. long. On mobilization, 8 service bridge trains are, in addition, organized, one being attached to every three divisions. Each of these trains consists of 42 bridge wagons and can span a gap 216 m. long.

The Italians had no cavalry bridge trains available heretofore, but contemplate to equip each cavalry division with one capable of bridging a gap 40 m. long.

Austria-Hungary.

An Austrian army corps, as a rule, has 4 bridge trains, each capable of forming a normal bridge 53 m. long, or all of them together capable of bridging a gap 211 m. long. Each corps train carries 8 trestles, 8 floating piers and 8 floor sections each 6.64 m. long. Each ponton (composed of 2 half-pontons) can carry 20 men and the ferry composed of two pontons has about the same capacity as that of the Germans.

The Austrian cavalry division has a cavalry bridge train of 8 wagons. This suffices for building a normal bridge 37 m. long or a light bridge (which is passable even for single mounted men) 58 m. long, and a foot bridge 98 m. long. There are 8

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pontons or 4 ferries available for ferrying. Each ponton can carry 18 men or 10 men and 10 horse equipments. In addition, each escadron is equipped with 10 and the pioneer platoon of each cavalry regiment with 8 raft sacks.

Russia.

Each division has sufficient equipage for a bridge 21 m. long. This bridge is however nothing but a reinforced light bridge. This type did not prove very successful during the Russo-Japanese war. A stronger type of bridge 32 m. long is at present being tested.

In addition, each army has a large bridge train which is operated by a ponton battalion of two companies. It consists of 104 wagons, which, among other equipment, carry 56 half-pontons. Each of the 28 complete pontons can carry 36 men, so that the entire army train can ferry 28 × 36, or 1000 men in round figures across a stream at one trip. This train carries enough equipage for building a bridge 240 m. long.

The Russian cavalry divisions have no bridge equipage.

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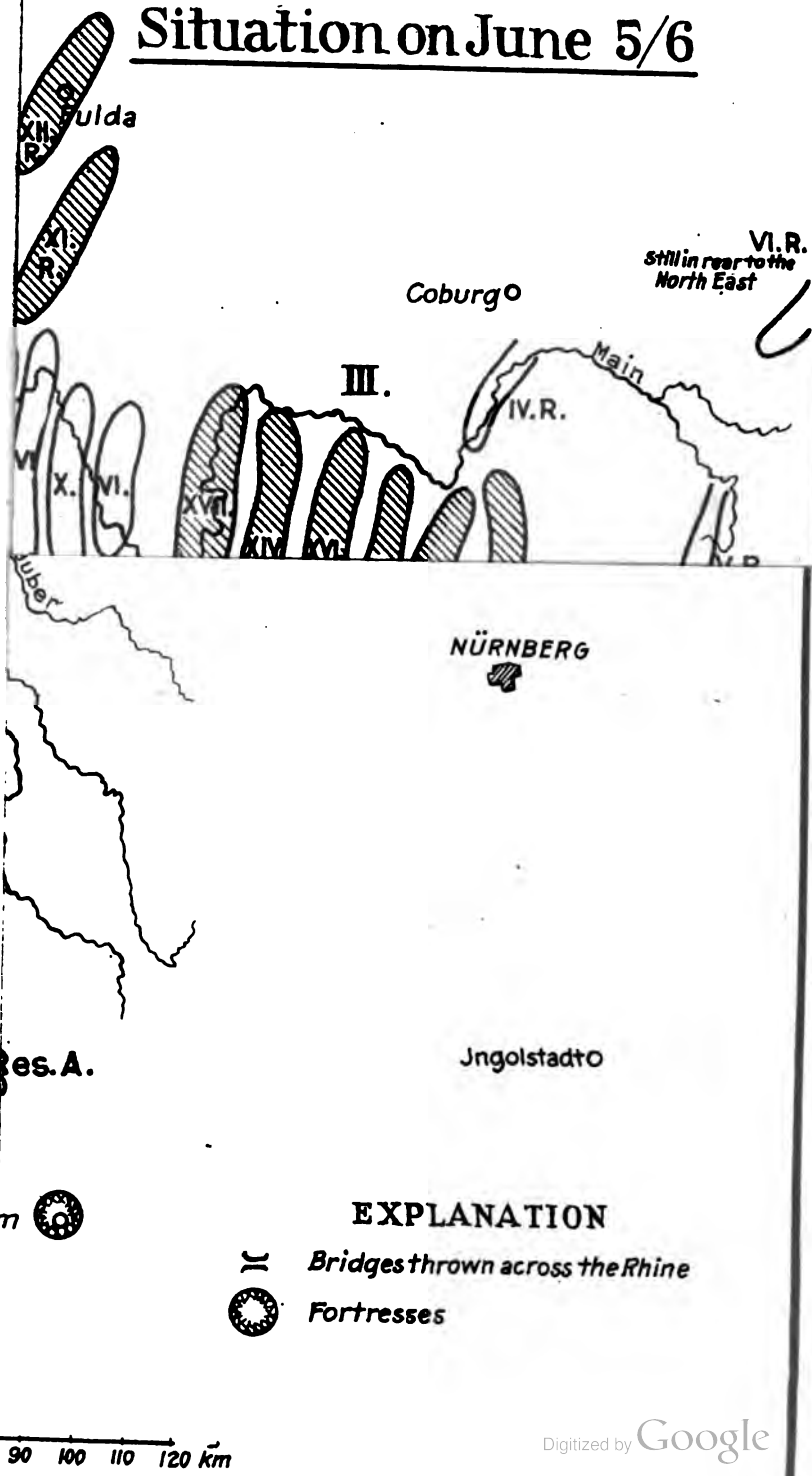
MAP 2

Situation on June 5/6



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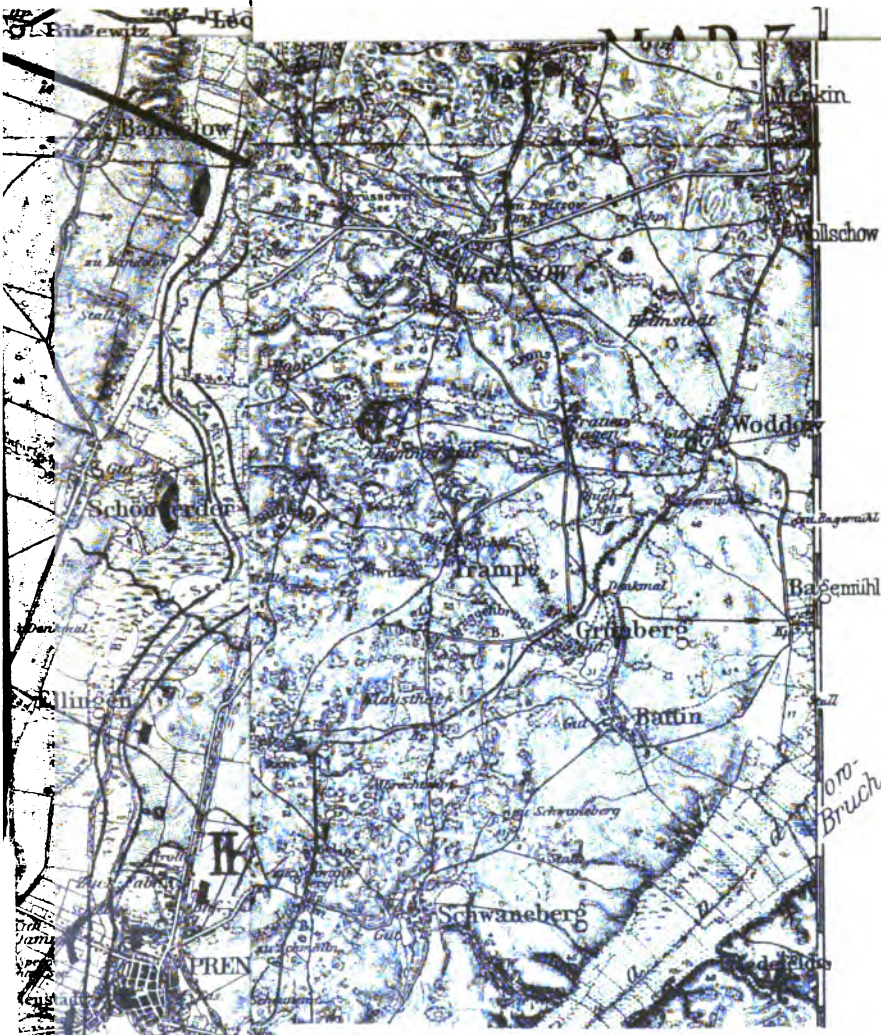

EXPLANATION

(Advance Posts

R. Regimental
A.R. Sector } Reserve
H.R. General

Abschnitt = Sector

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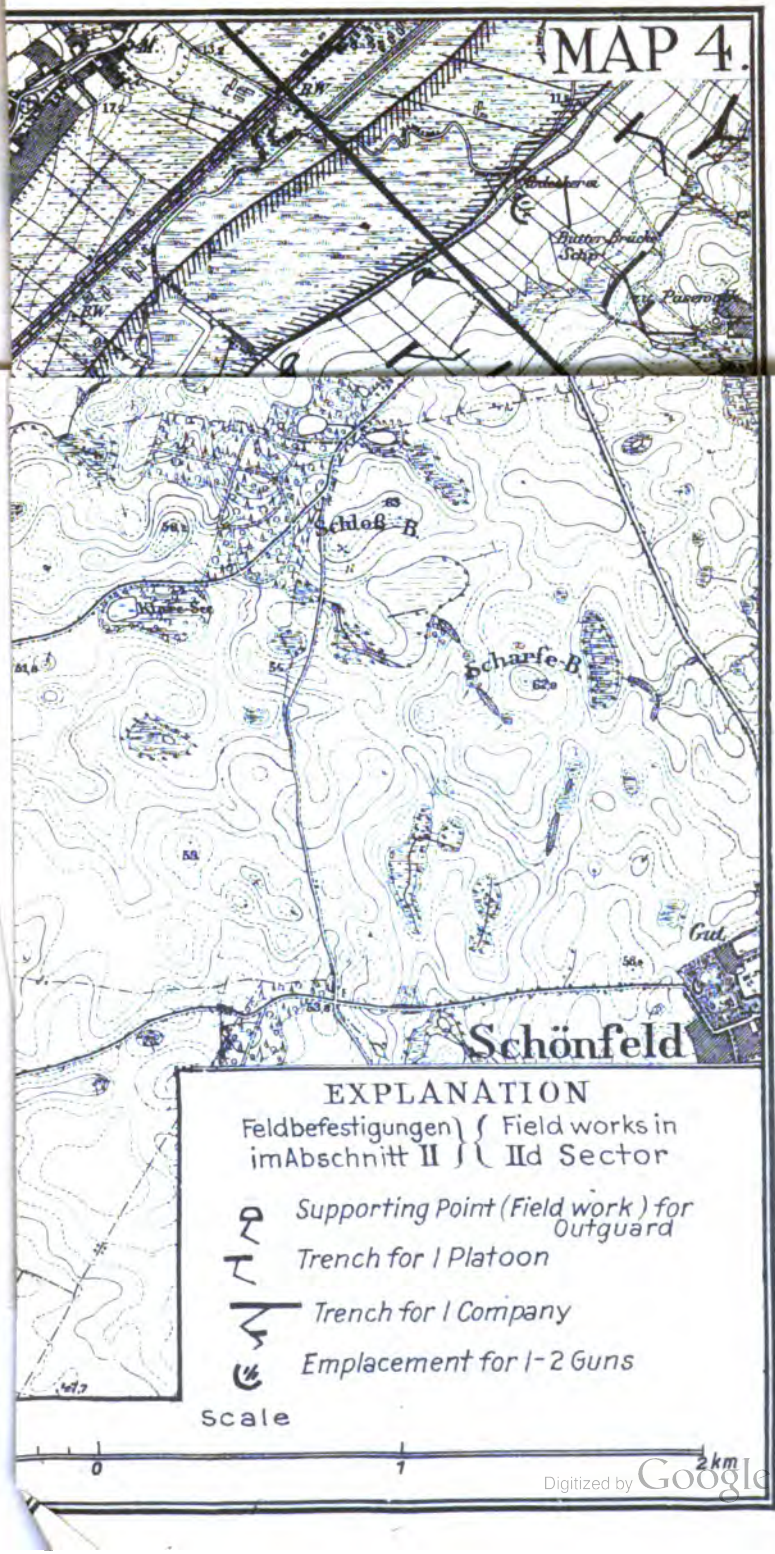

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